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FRIDAY,
DECEMBER 23, 1904.

PAGE'S WEEKLY

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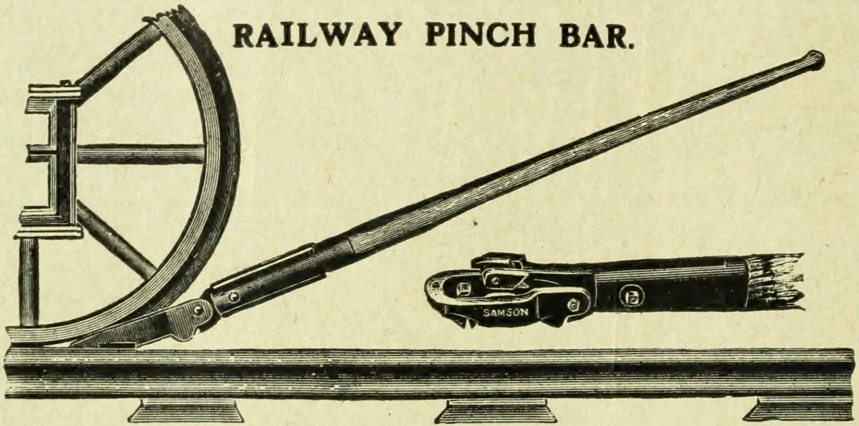

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PAGE'S WEEKLY Miscellaneous

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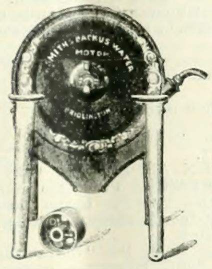

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Will drive any class of Machinery, and work on 15 lb. pressure.

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Second Edition, Revised. Price 7s. 6d.

DEPRECIATION OF FACTORIES, Mines, and Industrial Undertakings, and their Valuation. With Tables and Examples.

By EWING MATHESON, M.Inst.C.E.

The Principles which should guide the Writing off for wear and tear, Obsolete plant; Terminable or wasting properties; Effect on Income-tax; Value defined as for Compulsory purchase; Going concern, or dismantled; Rateable value, rental value.

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E. & F. N. SPON, 125, Strand, London.

JOSEPH BOOTH BROS., LTD., RODLEY, LEEDS. **See next week.**

LIFTING MACHINERY.

THOS. W. WARD, ALBION WORKS, SHEFFIELD. **See Page 20.**

MACHINE TOOLS.

THE SHANNON, LTD., Ropemaker St., London, E.C. **See Page 86.**

OFFICE APPLIANCES

Have you seen our Advertisement on page ~~69~~ 62. A glance at it may save you £500 per annum.—

ED. BENNIS & CO., Ltd., BOLTON.

"UNICA" SILENT GEARS

Equal in STRENGTH to, and MORE DURABLE than, Cast Iron, Gun Metal, or Rawhide.

NO SIDE PLATES OR BUSHES! UNAFFECTED BY OIL!

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Chartered Patent Agents.

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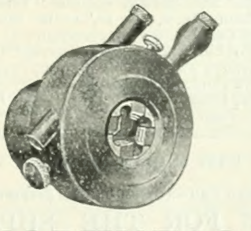

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The most satisfactory means yet devised for the production of screw threads.

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PAGE'S WEEKLY Contracts

CONTRACTS.

ASYLUMS COMMITTEE OF LONDON COUNTY COUNCIL.

The Asylums Committee of the London County Council are prepared to receive **TENDERS** for the **INSTALLATION of HEATING, VENTILATING, and HOT-WATER PLANT** at the Long Grove, Asylum, Epsom, Surrey, now in course of erection.

Instructions for Tender and forms of Tender and Contract, with specification and schedules thereto annexed, together with plans and cover, can be obtained from the Clerk of the Committee, No. 6, Waterloo Place, London, S.W., on or after Thursday, the 1st December proximo, on payment of a deposit of £5 for each copy. The amount deposited will, after the Committee have come to a decision upon the Tenders received, but not before, be returned to the tenderer, provided he shall have sent in a *bonâ fide* Tender and shall not have withdrawn the same.

Tenders must be on the printed form, and must be accompanied by the form of contract and schedules thereto and bond.

The Tender and accompanying documents, completed in accordance with the instructions, must be enclosed in the authorised sealed cover, endorsed "Tender for Heating, Long Grove Asylum," and be delivered at the Office of the Committee, 6, Waterloo Place, London, S.W., on or before Monday, the 23rd January, 1905, after which no Tender will be received.

Any Tender not made on the printed form, or not filled up and complete in every particular in accordance with the instructions, will be rejected.

The Committee do not bind themselves to accept the lowest or any Tender.

The contractor will have to enter into a bond in the penal sum of £2,000, with two approved sureties, each in the sum of £1,000, as security for the due performance of the contract.

R. W. PARTRIDGE,
Clerk of the Asylums Committee.

Asylums Committee Office,
6, Waterloo Place, London, S.W.,
November 16th, 1904.

GREAT WESTERN RAILWAY.—The Directors of this Company are prepared to receive **TENDERS** for the **SUPPLY** and **DELIVERY** of the following **MATERIAL** required in connection with the Electrical Equipment of the Hammersmith and City Railway, &c. :—

SPECIFICATION No. 8.—Steel Conductor Rails, Cast Iron and Steel Ramps and Fastenings.

SPECIFICATION No. 9.—Porcelain Insulating Supports, and their Fastenings for Conductor Rails.

SPECIFICATION No. 10.—Copper Bonds, Insulated Cable Connections, Cable Terminals, Bonding Presses and Accessories for connecting up Conductor Rails.

Copies of the specifications, forms of Tender, drawings, and general conditions, can be obtained, on and after Saturday, the 10th inst., except between the 23rd and 27th inst. inclusive, at the Offices of the Consulting Engineers, Messrs. KENNEDY AND JENKIN, 17, Victoria Street London, S.W., between the hours of 10 a.m. and 4 p.m. on payment of Two Guineas for each specification, which will be refunded on the receipt of a *bonâ fide* Tender.

The fee, which must be paid by cheque, will not be returnable until the Tenders have been adjudicated upon.

Tenders, addressed to "The Secretary, Great Western Railway, Paddington Station, W.," and marked outside "Tender for Electrical Equipment, Specification No. 8, 9, or 10," as the case may be, will be received on or before Tuesday, the 3rd proximo.

The Directors do not bind themselves to accept the lowest or any Tender, and no allowance will be made for any expense incurred in the preparation of the Tender.

Paddington Station, London,
December 7th, 1904.

G. K. MILLS,
Secretary.

EAST INDIAN RAILWAY.

The East Indian Railway Company is prepared to receive

TENDERS FOR THE SUPPLY AND DELIVERY of :—

STEEL MATERIAL (Plates, Bars, Joists, &c.),

as per specification to be seen at the Company's Offices.

Tenders are to be sent to the undersigned, marked "Tender for Steel Material," not later than Twelve o'clock noon on Wednesday, the 4th day of January, proximo.

The Company reserves to itself the right to divide the order, also to decline any Tender without assigning a reason, and does not bind itself to accept the lowest or any Tender.

For each specification a fee of £1 1s. is charged, which cannot under any circumstances be returned.

By order,
C. W. YOUNG,
Secretary.

Nicholas Lane, London, E.C.,
December 15th, 1904.

LINSLADE URBAN DISTRICT COUNCIL.

SEWERAGE AND SEWAGE DISPOSAL WORKS TO CONTRACTORS.

The above Council invite **TENDERS** for **SEWERAGE** and **SEWAGE DISPOSAL WORKS** for the above district.

The Contract will comprise Stoneware and Iron Pipe Sewers from 12in. to 6in. diameter, with Manholes, Flush Chambers, &c., and 6in. Cast Iron Pumping Main, Construction of Storage Tanks, Enginehouse, Storm-water Filter, Concrete Sewage Tanks, Percolating Filters and Laying Out 4 Acres of Land, &c., &c.

Plans, conditions, and specifications may be seen, and copies of quantities and form of Tender obtained from the Engineers, Messrs. SANDS AND WALKER, Milton Chambers, Nottingham, on and after December 10th, between the hours of 9 a.m. and 6 p.m., on payment of 5 guineas (by cheque), which will only returned on receipt of a *bonâ fide* Tender, not afterwards withdrawn, and the return of all documents entrusted to them.

Sealed and endorsed Tenders to be sent to the undersigned on or before 6 p.m., December 28th.

The successful contractor will be required to enter into a bond, with approved sureties, for the due performance of his Contract.

The Council do not bind themselves to accept the lowest or any Tender.

R. J. PLATTEN,
Linslade, Leighton Buzzard. Clerk to the Council.

The Engineers will meet Contractors at Council Offices, Linslade, Twelve noon, on Wednesday, December 21st, to show them over the proposed sites.

WATERWORKS OF CRAIOVA (ROUMANIA).

The Town Administration invite

TENDERS FOR :—

CONTRACT NO. 5.

About 27,850 metre **MAIN CAST-IRON ADDUCTION PIPE**, 500 mm. diam., and 5,925 metre **MAIN PRESSURE PIPE**, 300 mm. diam. Contract to comprise Excavations, complete Laying and Caulking of Pipes, Fixing of Fittings, of the Manholes, Crossings, Outlets, Sheet Pilings, and all Accessory Work.

Further information may be obtained from the "Bureau de l'approvisionnement d'Eau," in Craiova, Strada Solomon 5, whence Specifications of Contract and official Forms of Tenders may be had in the Roumanian or German language, on payment of Five Lei.

All Tenders to be sent on the Official Forms, accompanied by the prescribed guarantee, post paid, sealed, addressed to "Le Maire de la Ville de Craiova (Roumania), N. P. ROMANESCUE," at or before Eleven a.m., the 16th to 29th December, 1904, at which hour they will be opened in the presence of such of the Tenderers or their Representatives as may be present.

The Tenderer remains bound to his Tender up to the 16th February to 1st March, 1905.

Le Maire de la Ville de Craiova,
Craiova, October 12th, 1904. G. N. PESSICU.

PORT ELIZABETH MUNICIPAL CORPORATION ELECTRICITY SUPPLY.

The Agents of the Municipal Corporation of Port Elizabeth, South Africa, are prepared to receive **TENDERS** for the **EXECUTION** of the following **WORKS** in connection with the Corporation Electricity Supply undertaking: Section A. Boiler-house Plant—Three marine type water-tube boilers, superheaters, economisers, chimneys, pipework, tanks, electrically driven feed pumps and accessories. Section B. Engine-room Plant—Three 400 kilowatt steam turbines and dynamos, surface condensers, electrically driven pumps, pipe work and accessories. Section C. Electricity Supply Mains—Cables, pillars, boxes and accessories. Section D. Accumulators and Boosters—Battery of accumulators, reversible boosters, milking booster and accessories. Section E. Switchboard and Instruments—Main and auxiliary switchboards, instruments, apparatus and accessories. Section F. Crane—Ten-ton overhead hand travelling crane. Section G. Public Lighting—Ten-ampère arc lamps, three-ampère enclosed arc lamps, Nernst lamps, arc pillars, brackets and accessories. Section H. Meters—Motor and electrolytic meters. Section I. Workshop Equipment—Machine tools, motor, fitters', smiths', and joiners' tools, lifting gear, mains department equipment.

Applicants must state for which section or sections they wish to tender, in order that the requisite drawings may be forwarded to them. Tenderers are at liberty to tender for any one of or for all the sections, but not for part of a section. The specification, with terms and conditions, forms of tenders and form of contract, may be obtained from the undersigned, on making a deposit of £5 5s., which sum will be refunded on the return of the specification filled up with a *bonâ fide* Tender. Extra copies of the specification may be obtained by *bonâ fide* tenderers at a charge of Five Shillings per copy, which will not be refunded. Tenders (sealed and marked "Tender for Electrical Plant") must be delivered to the undersigned before noon on Monday, January 16th, 1905.

The Municipal Corporation does not bind itself to accept the lowest or any Tender.

DAVIS and SOPER,
Agents to the Municipal Corporation of
54, St. Mary Axe, London, E.C. Port Elizabeth, South Africa.

PAGE'S WEEKLY Contracts

TOTTENHAM AND WOOD GREEN
JOINT DRAINAGE COMMITTEE.
TO CONTRACTORS.

The Committee invite **TENDERS** for the **PROVISION** and **LAYING** of a 30 in. **CAST IRON PUMPING MAIN**, from the Sewage Works to the London County Council Sewer, Craven Walk, and works in connection therewith.

The plans can be seen, and general conditions, specifications, bills of quantities, schedule of prices, and forms of Tender, can be obtained on application to P. E. MURPHY, Esq., M.I.C.E., Engineer to the Committee, or W. H. PRESCOTT, Esq., M.Inst.Mech.E., Consulting Engineer, at their offices, Coombes Croft House, 712, High Road, Tottenham, any day during office hours.

The sum of Ten Shillings will be charged for the quantities, which will be returned on receipt of a *bonâ fide* Tender, accompanied by the conditions, specification, and quantities, otherwise the deposit will be forfeited.

Persons tendering will be required to deposit with the Clerk, when handing in their Tenders, in Bank of England notes or cash, the sum of £10, which will be forfeited by the person whose Tender is accepted if the contract be not executed within seven days from the date he is informed it is ready for signature.

This deposit will be repaid to the parties tendering who are unsuccessful.

The contractor will be required to pay all workmen on the Committee's work the recognised trade union rate of wages. A schedule of such wages will be inserted in the contract, and a copy of the schedule must be exhibited on the pay-office at the works.

Sealed Tenders, on the form supplied, endorsed "Tender for Pumping Main," to be delivered to me by Twelve o'clock noon on the 3rd day of January, 1905.

No other form of Tender will be received.

Security will be required for the due performance of the contract.

The Committee will not be bound to accept the lowest or any Tender.

By order,
EDWARD CROWNE,
Clerk of the Committee.
Tottenham, December 8th, 1904.

URBAN DISTRICT OF ERITH.
TRAMWAYS.
The Erith Urban District Council invite

TENDERS FOR:—

CONTRACT No. 5.
OVERHEAD LINE EQUIPMENT, POLES, &c.
CONTRACT No. 6.
UNDERGROUND FEEDER CABLES, BOXES, &c.
CONTRACT No. 7.
ROTARY CONVERTERS, TRANSFORMERS and MOTOR BOOSTER.
CONTRACT No. 8.
MAIN HIGH and LOW-TENSION SWITCHBOARDS, CABLE CONNECTIONS, &c.

Copies of specifications with forms of Tender, general conditions, &c., may be obtained from the undersigned, on depositing the sum of £5, which sum will be returned on receipt of a *bonâ fide* Tender.

Plans and specifications may be seen at, but not obtained from, the offices of Messrs. HAWTAYNE AND ZEDEN, of 9, Queen Street Place, London, E.C., the Consulting Engineers to the Council.

The contract will provide that the Contractor shall pay not less than the standard rates of wages, and observe the conditions of labour customary in the district where the work is executed.

Persons tendering are at liberty to Tender for either or all of the contracts, but not for part only of one contract.

Tenders, sealed and marked "Tramways Contract No..........Tender," to be addressed to the undersigned, and delivered at or before Twelve o'clock Noon on Monday, the 9th day of January, 1905.

Dated this 9th day of December, 1904.

CHARLES H. FRY,
Clerk of the Council.
District Council Offices, Erith, Kent.

CRICKLADE AND WOOTTON BASSETT RURAL DISTRICT COUNCIL.
TO CONTRACTORS.
CRICKLADE WATER SUPPLY.—CONTRACT No. 1.
The above Council invite

TENDERS FOR THE CONSTRUCTION

and **MAINTENANCE** of **WORKS** for supplying the Town of Cricklade with water.

This contract comprises the **CONSTRUCTION** of a **CONCRETE COLLECTING TRENCH, BRICK ENGINE HOUSE** and **STORE, CONCRETE FILTERS** and **TANKS**, and **COVERED SERVICE RESERVOIR** of about 50,000 gallons capacity.

PROVIDING, LAYING and **JOINTING** about 4,000 yards of 4 in. and about 2,300 yards of 3 in. **CAST IRON MAINS** and **BRANCHES**, with Valves, Hydrants and Fittings, and other work in connection therewith.

Persons desiring to submit Tenders may see the plans, sections, and specification, and obtain a copy of the schedule of quantities and form of Tender and other particulars, upon application to the Engineer Mr. F. REDMAN, 34, Wood Street, Swindon, Wilts., and upon payment of the sum of Five Guineas, on and after the 15th instant, between the hours of Ten a.m. and Five p.m. (Saturdays, Sundays, and 26th instant excepted).

The deposit will, after the Council have come to a decision upon the Tenders received, be returned to contractors who have sent in a *bonâ fide* Tender, with the schedule of quantities properly priced and signed in ink.

The contractor whose Tender is accepted will have to enter into a formal agreement, under seal, with approved sureties for £500, for the due performance of the contract.

The Council does not bind itself to accept the lowest or any Tender, nor to pay any expenses incurred by parties tendering.

Sealed Tenders, endorsed "Cricklade Water Supply," must be delivered at my Office not later than Noon on Tuesday, January 3rd, 1905.

By order,
(Signed) H. BEVIR,
Wootton Bassett, December 7th, 1904. Clerk to the Council.

MANSFIELD WOODHOUSE SEWERAGE.

The Mansfield Woodhouse Urban District Council are prepared to receive **TENDERS** from competent contractors willing to enter into a contract for the **CONSTRUCTION** of **SEWERAGE** and **SEWAGE DISPOSAL WORKS** for their district, comprising a 12 in., 15 in., and 18 in. Main Intercepting and Outfall Sewer, Two Brickwork Storage Tanks, Pumping Station Buildings and Machinery, Pumping Main, and Laying Out about 45 acres of land for the disposal of the Sewage, together with all Manholes, Valves, and other appurtenant works.

The drawings and specification may be seen at the Loughborough office of the Engineers, Messrs. GEORGE AND F. W. HODSON, and schedule of quantities and Tender form may be obtained from them on deposit of a cheque for £5 5s., which will be refunded to every person making a *bona fide* Tender, on the return of the documents entrusted to him.

In the event of a Tender being withdrawn, the deposit will be forfeited.

Sealed Tenders, endorsed "Tender for Sewerage Works," are to be sent to the undersigned so as to arrive not later than Monday, January 2nd, 1905.

The Council do not bind themselves to accept the lowest or any Tender,

Dated this 7th day of December, 1904.

J. E. ALCOCK,
Mansfield, Notts. Clerk to the Urban Council.

APPOINTMENTS OPEN.

MARTELL SCHOLARSHIP IN NAVAL ARCHITECTURE.

A **SCHOLARSHIP** of the annual value of £50, and subject to certain conditions, tenable for three years, will be **OFFERED** for **COMPETITION** by the Institution of Naval Architects.

Candidates must not be less than 18 or more than 21 years of age on March 1st, 1905, and must at that date have been continuously employed for two years upon naval architecture or marine engineering.

Further particulars may be obtained from the SECRETARY of the Institution of Naval Architects, 5, Adelphi Terrace, London, W.C. (envelopes to be marked "Martell Scholarship").

Applications must be sent in by February 1st, 1905.

NORTHAMPTON INSTITUTE, ST. JOHN STREET ROAD, E.C.

The Governing Body **INVITE APPLICATIONS** for the **POST** of **CHIEF ASSISTANT** in the Mechanical Engineering Department, rendered vacant by the appointment of Mr. W. E. Curnock to be Head of the Engineering Department at the Technical College, Huddersfield.

The appointment is a full time appointment for day and evening work.

Salary £180 per annum.

For further particulars and forms of application, which should be returned not later than 10 a.m. on Tuesday, January 3rd, 1905, apply to

R. MULLINEUX WALMSLEY, D.Sc., Principal.

WOOLWICH POLYTECHNIC.
Principal—WILLIAM GANNON, M.A.
The Governors invite

APPLICATIONS FOR THE POST OF LECTURER AND DEMONSTRATOR IN ENGINEERING

Commencing salary £150 per annum. Particulars of the post may be obtained from the Principal on receipt of a stamped addressed foolscap envelope. All applications, to be made on special forms, must be lodged with the Principal before December 31st, 1904.

A. J. NAYLOR,
December 14th, 1904. Clerk to the Governors.

BUYERS' DIRECTORY.

NOTE.—*The display advertisements of the firms mentioned under each heading can be found readily by reference to the Alphabetical Index to Advertisers on pages* 43, 45, 46, *and* 48.

In order to assure fair treatment to advertisers, each firm is indexed under its leading speciality ONLY.

Advertisers who prefer, however, to be entered under two or more different sections can do so by an annual payment of 5s. *for each additional section.*

Artesian Well Machinery.
John Z. Thom, Patricroft, Manchester.

Belting.
Binney & Son, Catherine Street. City Road, London, E.C.
Fleming, Birkby & Goodall, Ltd., West Grove, Halifax.
Gilmour, W. & O., St. John's Hill, Edinburgh.
Rossendale Belting Co., Ltd.. 10, West Mosley Street, Manchester.

Boilers.
Clayton, Son & Co., Ltd., Leeds City Boiler Works, Leeds.
Grantham Crank & Iron Co., Ltd., Grantham.
John Thompson, Wolverhampton.

Boilers (Water-tube).
Babcock & Wilcox, Ltd., Oriel House, Farringdon Street, London, E.C.
Cochran & Co. (Annan), Ltd., Annan, Scotland.
Hartley & Sugden, Ltd., Halifax.

Bolts, Nuts, Rivets, etc.
Herbert W. Periam, Ltd., Floodgate Street Works, Birmingham.
T. D. Robinson & Co., Ltd., Derby.

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Crosby Lockwood & Son, Stationers' Hall Court, London, E.C.
Griffin, Charles, & Co., Exeter Street, Strand, W.C.
New Zealand Mines Record, Wellington, New Zealand.
Spon, E. & F. N., 125, Strand, W.C.

Cables.
St. Helen's Cable Co., Ltd., Warrington, Lancashire.

Case-Hardening Compounds.
Hy. Miller & Co.. Millgarth Works, Leeds.

Catalogues, Printing, &c.
Atlantic Press, Ltd., Weymouth Street, Manchester.
Southwood, Smith & Co., Ltd., Plough Court, Fetter Lane, London, E.C.
Spottiswoode Advertising Agency, 8, New Street Square, E.C.

Chucks.
Fairbanks Co., 78-80, City Road, London, E.C.

Cisterns, Tanks, &c.
F. A. Keep, Juxon & Co., Barn Street, Birmingham.

Clutches (Friction).
David Bridge & Co., Castleton Ironworks, Rochdale, Lancashire.
H. J. H. King & Co., Nailsworth, Gloucestershire.

Colliery Plants.
Graham, Morton & Co., Ltd., Leeds.

Condensing Plant.
Concentric Condenser, Ltd., 23, Northumberland Avenue, London, W.C.
Mirrlees-Watson & Co., Ltd., Glasgow.

Condensed Water Purifiers.
Lassen & Hjort, 52, Queen Victoria Street, London, E.C.

Consulting Engineers.
Gibbs, John, & Son, 80, Juke Street, Liverpool.
G. H. Hughes, A.M.I.M.E., 97, Queen Victoria Street, London, E.C.

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South Eastern & Chatham Railway Co.

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Brown Hoisting Machinery Co.. 39, Victoria Street, London, S.W.
Fraser & Chalmers, Ltd., 3, London Wall Buildings, London, E.C.
Graham, Morton & Co., Ltd.. Leeds.
Temperley Transporter Co., 72, Bishopsgate Street Within, London, E.C.

Coverings (Boiler).
Magnesia Coverings, Ltd., Washington Station, co. Durham.

Cranes, Travellers, Winches, etc.
Joseph Booth & Bros. Ltd, Rodley, Leeds.
Thomas Broadbent & Sons, Ltd., Huddersfield.
Niles-Bement Pond Co., 23-25, Victoria Street, London, S.W.

Cranks.
Clarke's Crank & Forge Co., Ltd., Lincoln, England.

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E. G. Wrigley & Co., Ltd., Foundry Lane Works, Soho, Birmingham.

Destructors.
Horsfall Destructor Co., Ltd., Armley, Leeds.

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Delange & Cie. Mce., Hoboken, near Antwerp.
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Economisers.
E. Green & Son, Ltd., Manchester.

Ejectors (Pneumatic).
Hughes & Lancaster, 47, Victoria Street, London, S.W.

Electrical Apparatus.
Allgemeine Elektricitäts Gesellschaft, Berlin, Germany.
Broadbent, T. W., Victoria Electrical Works, Huddersfield.
Bruce Peebles & Co., Ltd., Edinburgh.
Brush Electrical Engineering Co., Ltd., Victoria Works Belvedere Road, London, S.E.
Crompton & Co., Ltd., Arc Works, Chelmsford.
Crypto Electrical Co., 3, Tyer's Gateway, Bermondsey Street, London, S.E.
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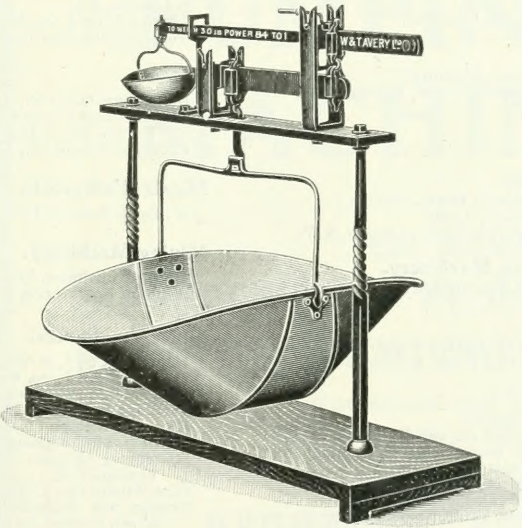
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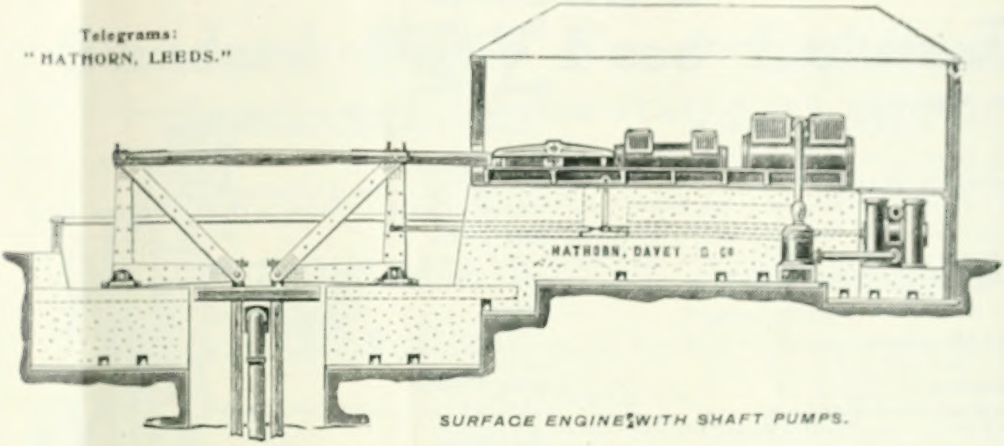

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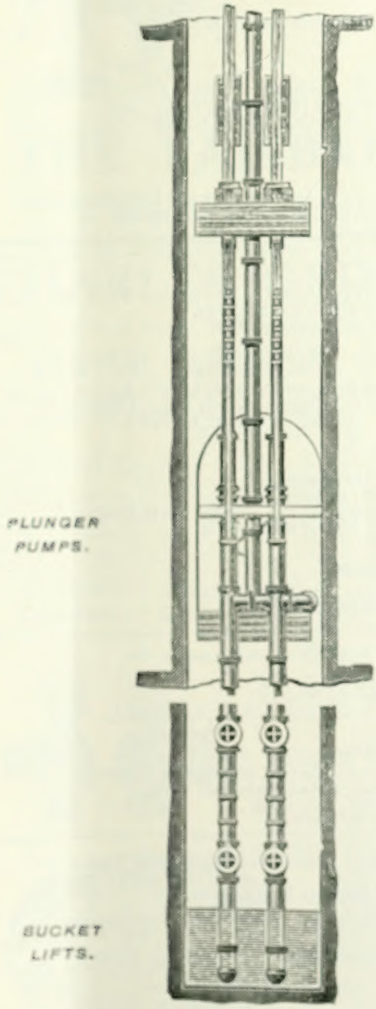

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Hathorn, Davey & Co., Ltd., Leeds, England.
Positive Rotary Pumps, Ltd., 23, Northumberland Avenue, London, W.C.
Tangyes, Ltd., Cornwall Works, Birmingham.

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Lancaster & Tonge, Ltd., Pendleton, Manchester.

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Thornycroft & Co., Ltd., J. I., Chiswick, London, W.
Yorkshire Patent Steam Wagon Co., Pepper Road, Hunslet, Leeds.

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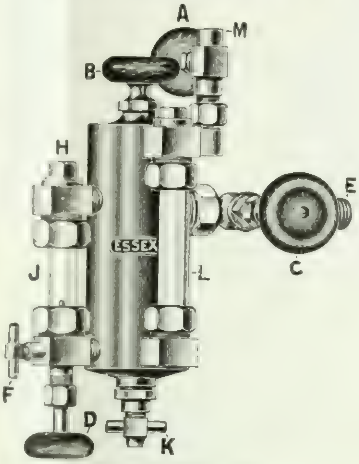

Fig. 10—Type A.

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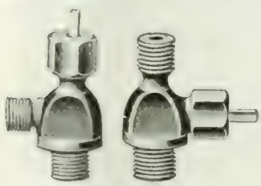

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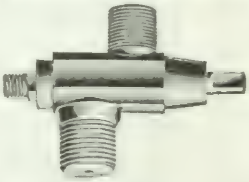

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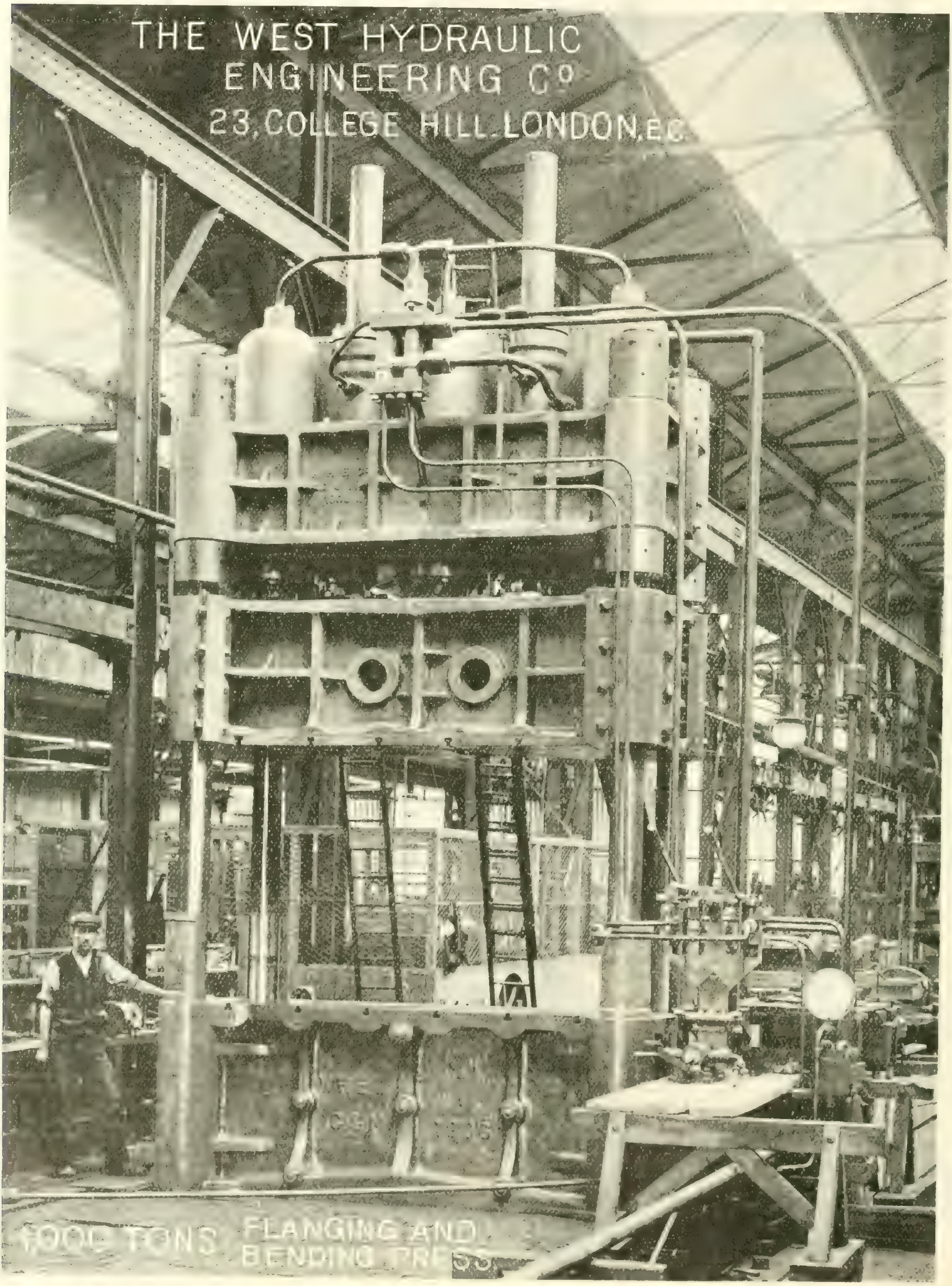
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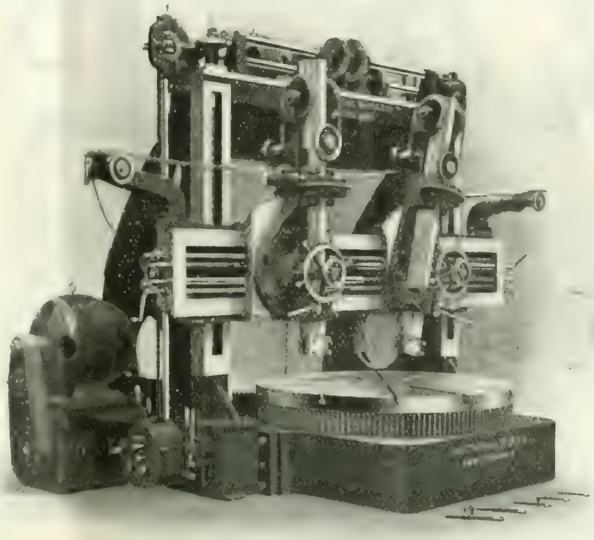

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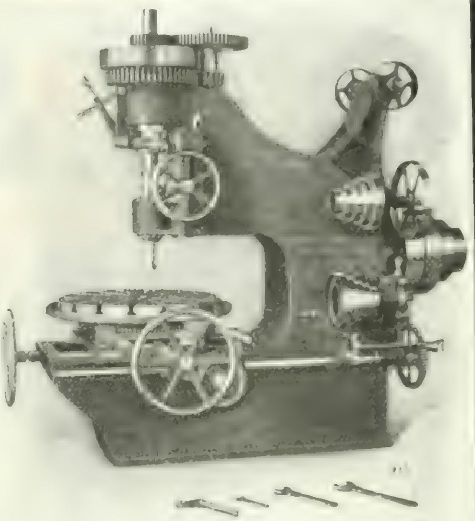

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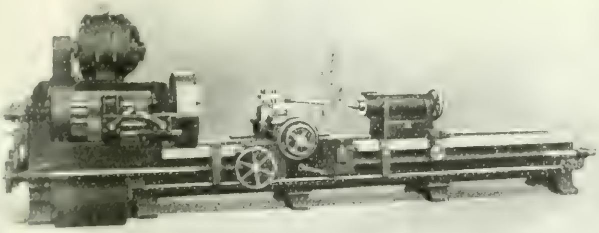

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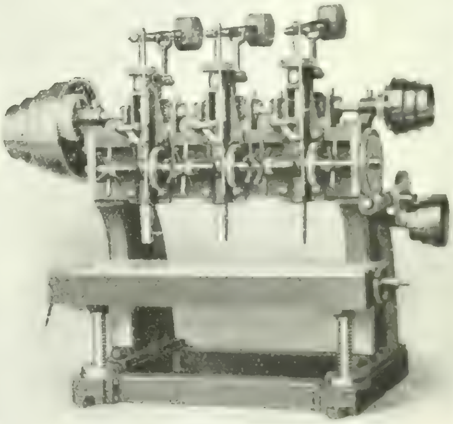

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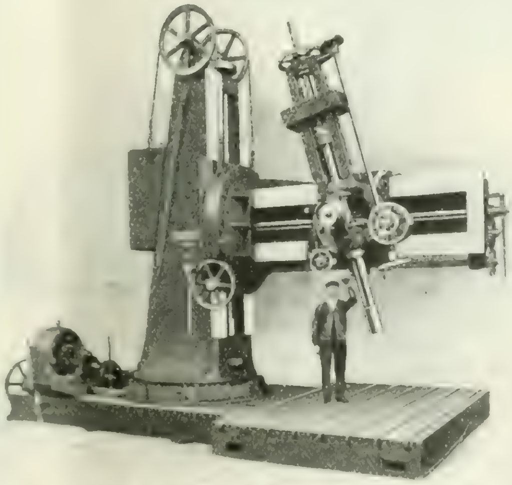

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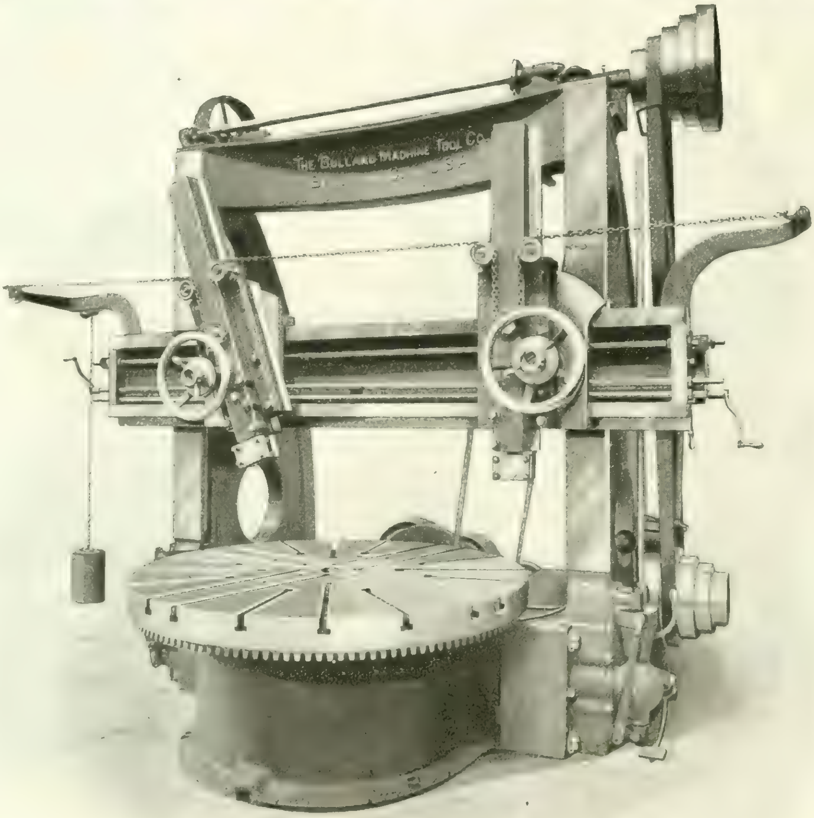

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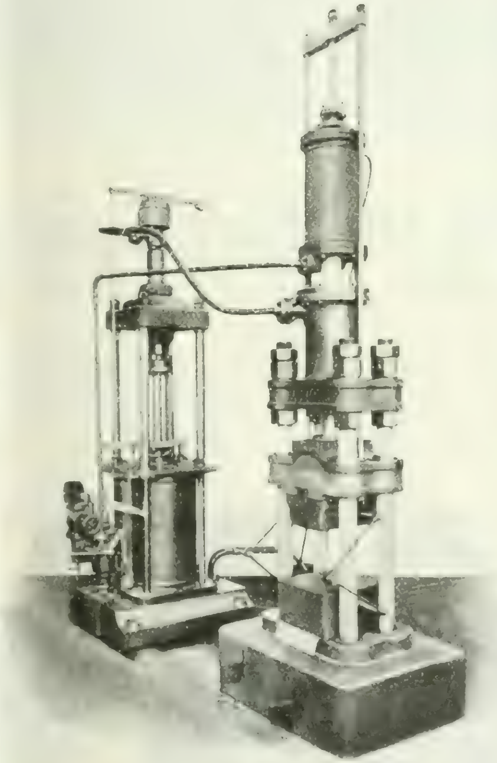

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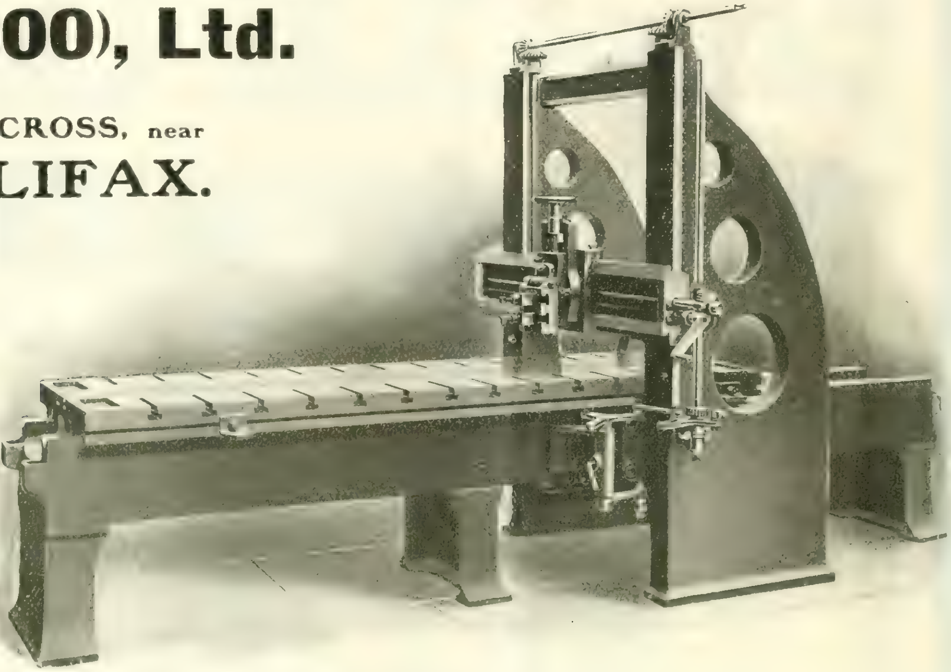

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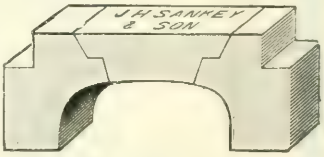

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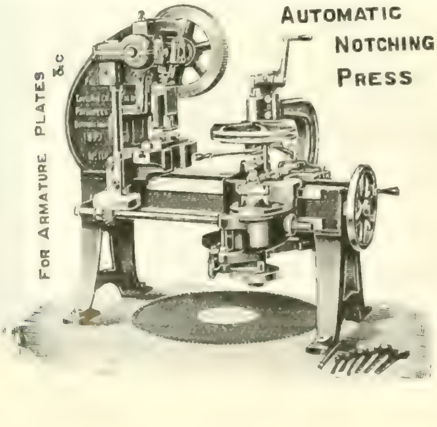

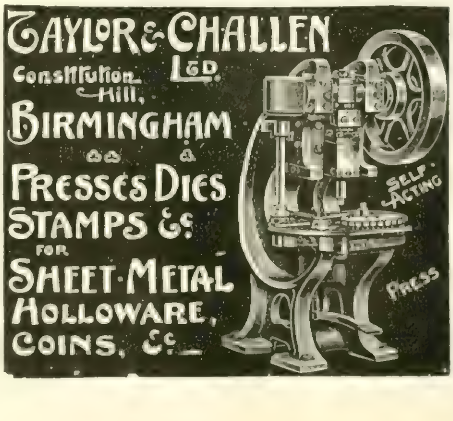

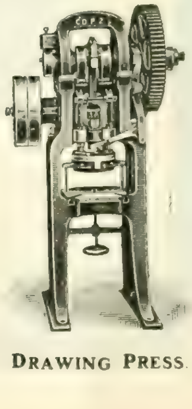
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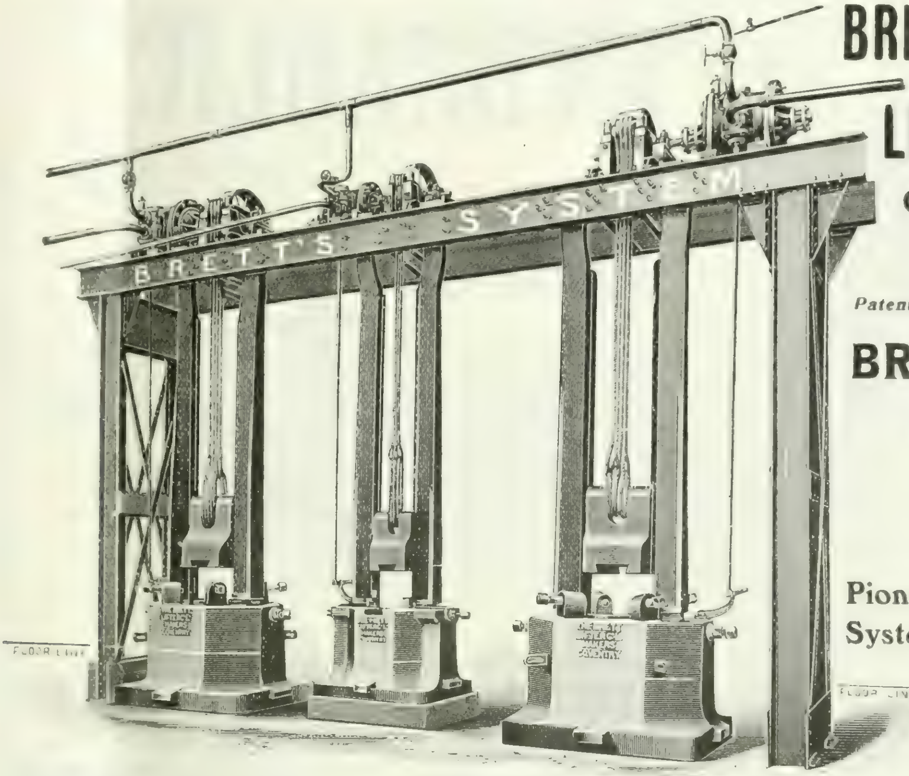

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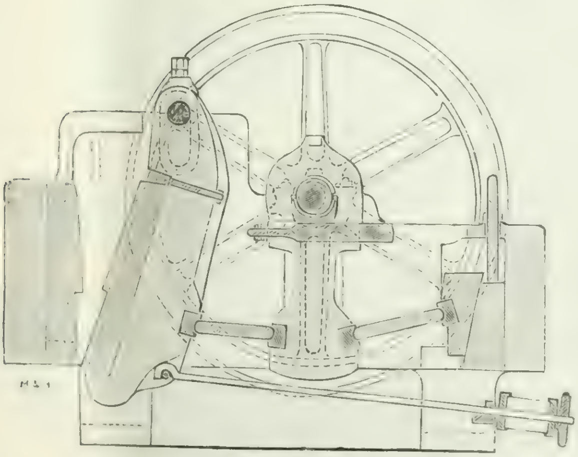

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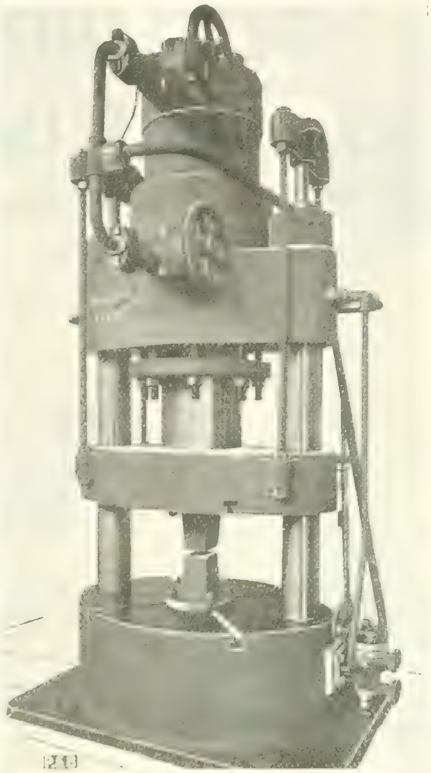

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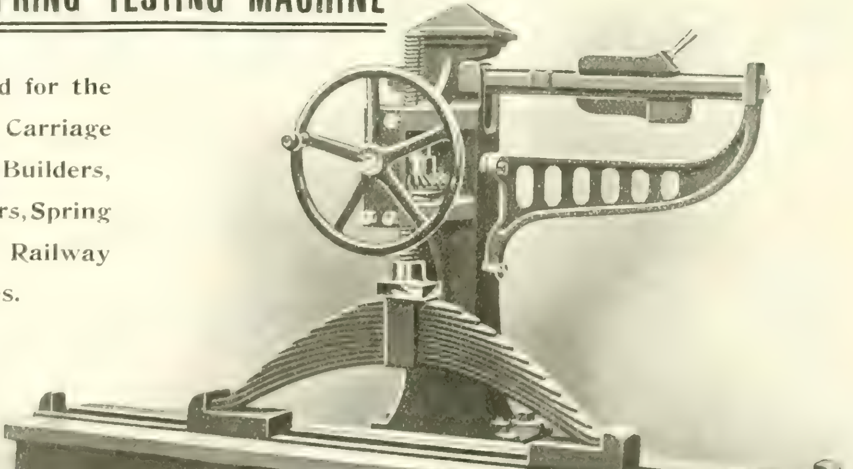

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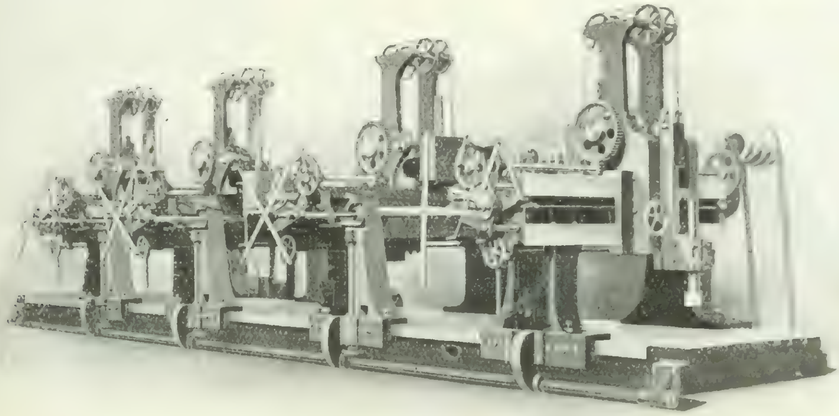

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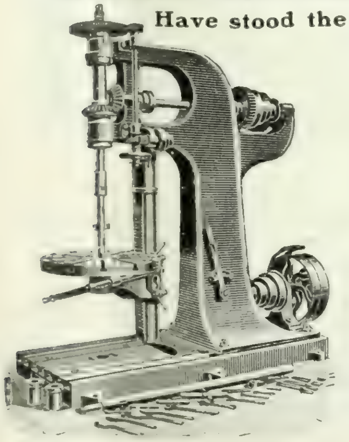

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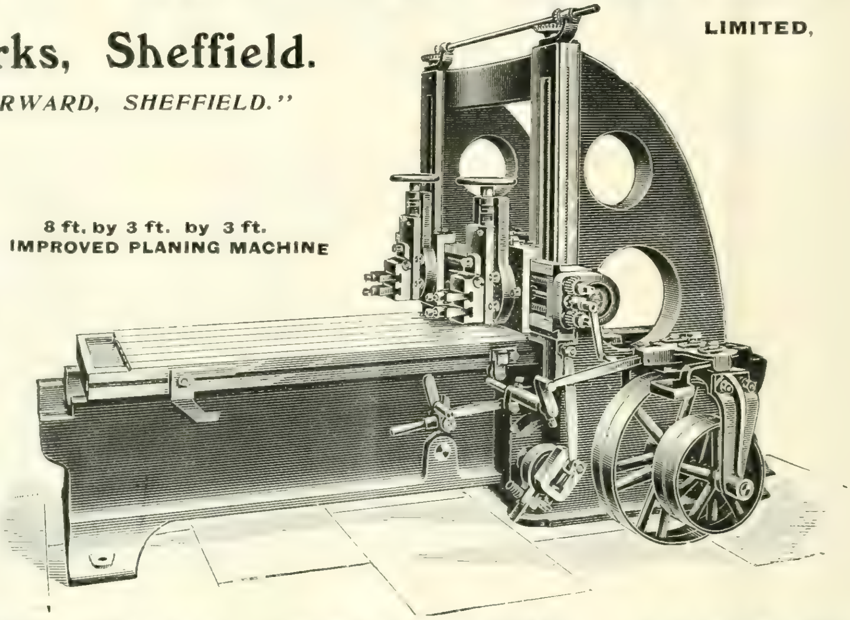

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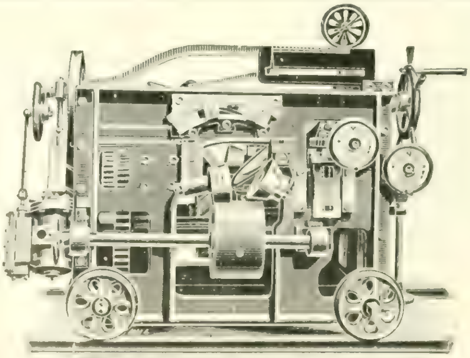

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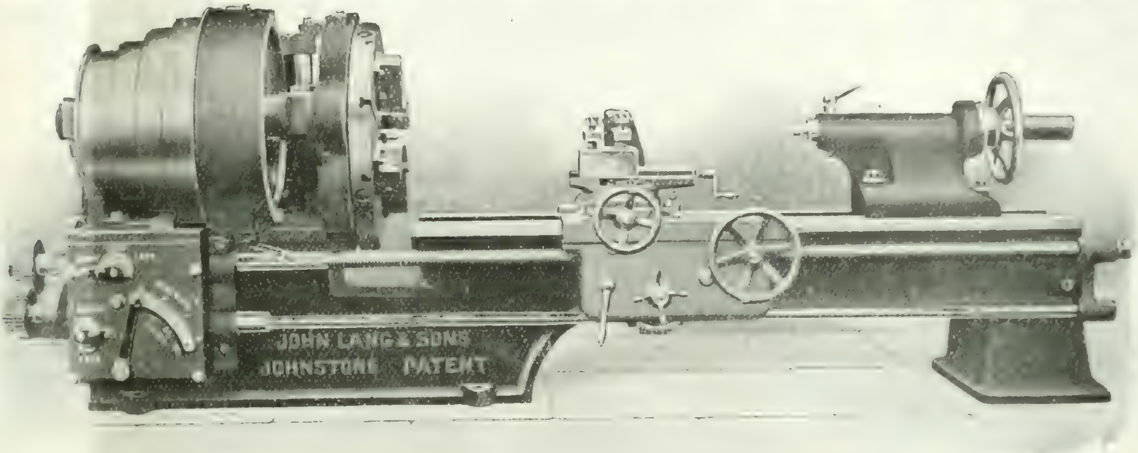

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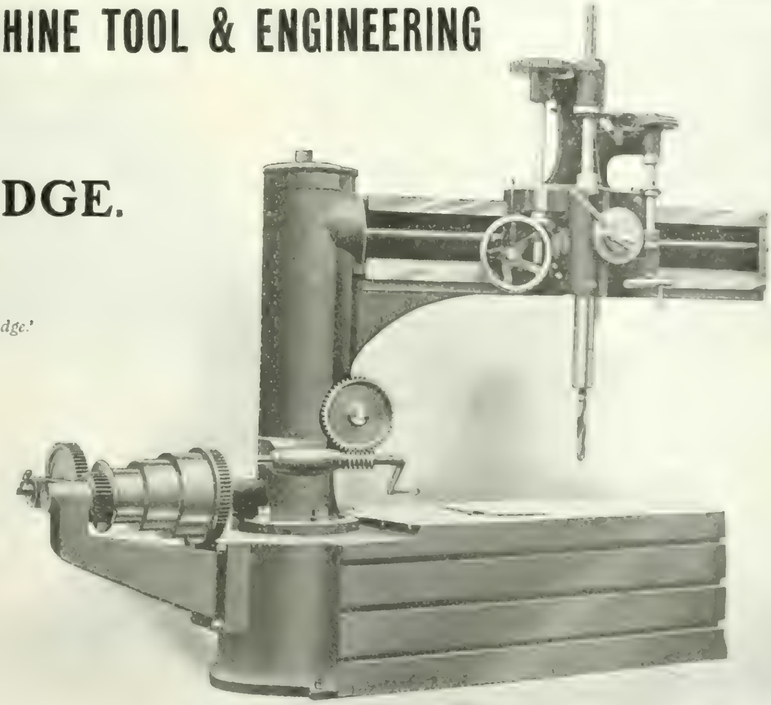

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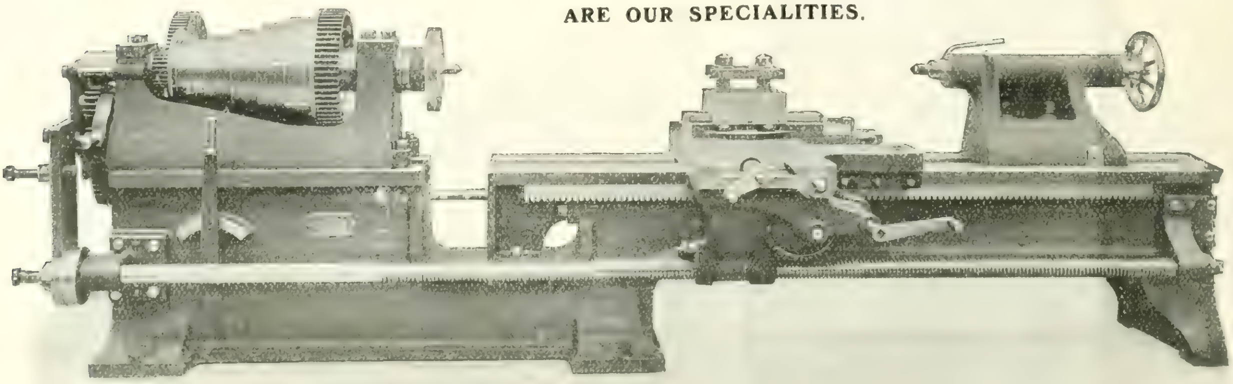

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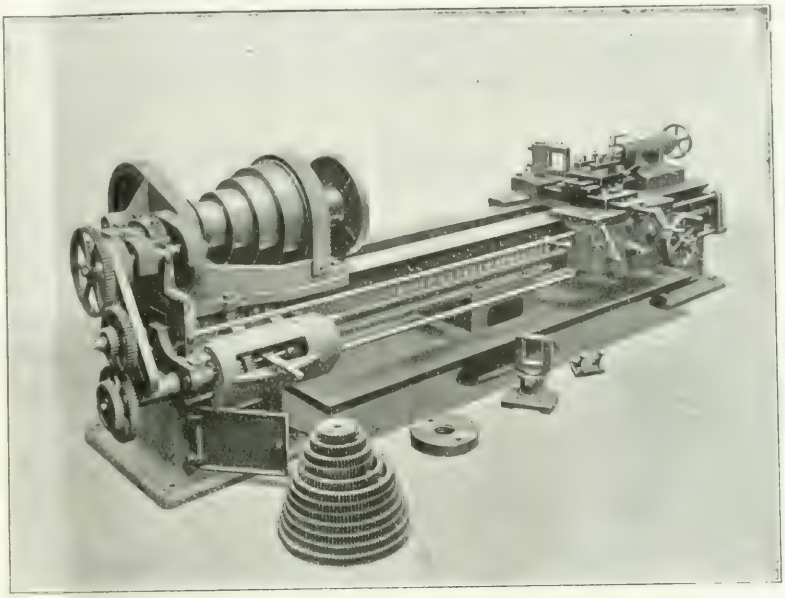

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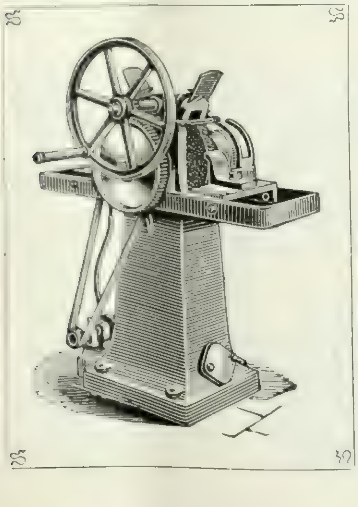

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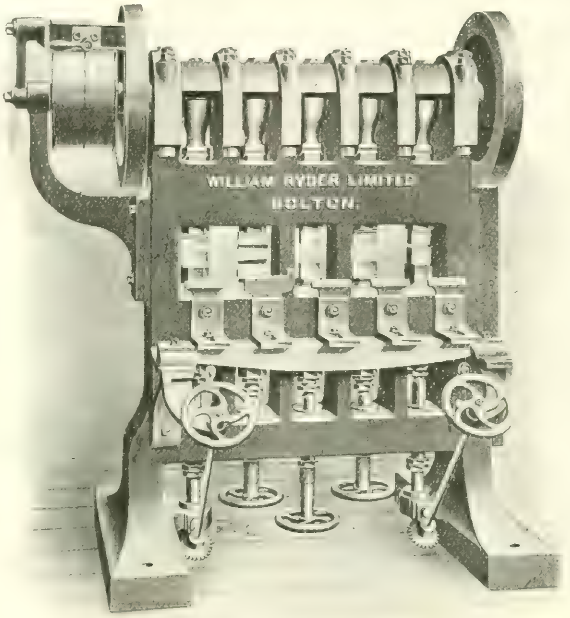

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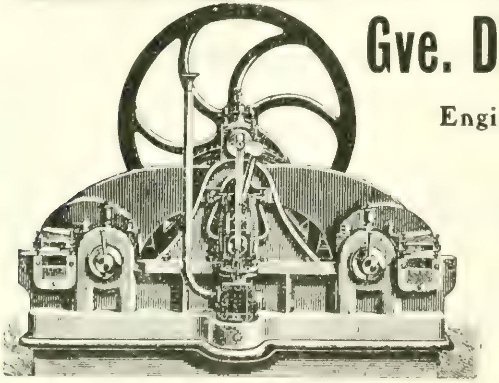

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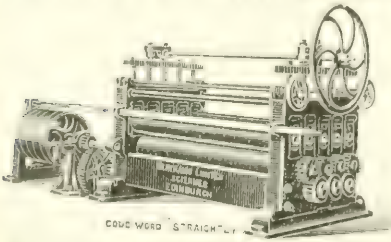

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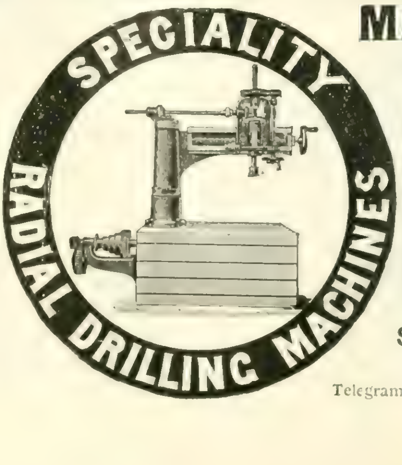

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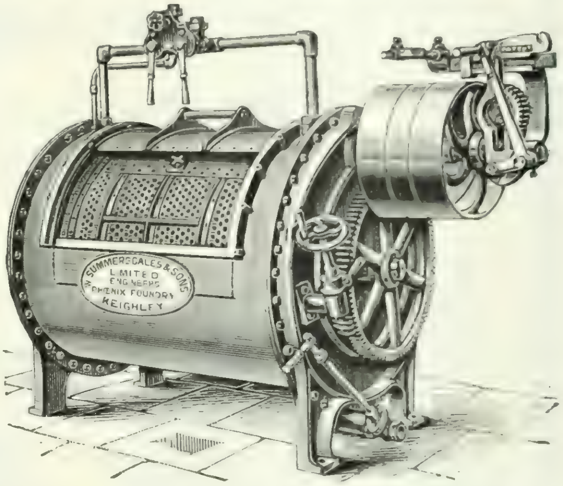

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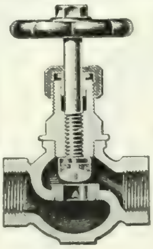

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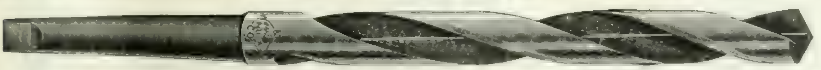

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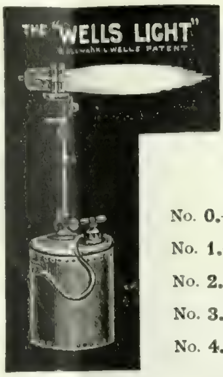

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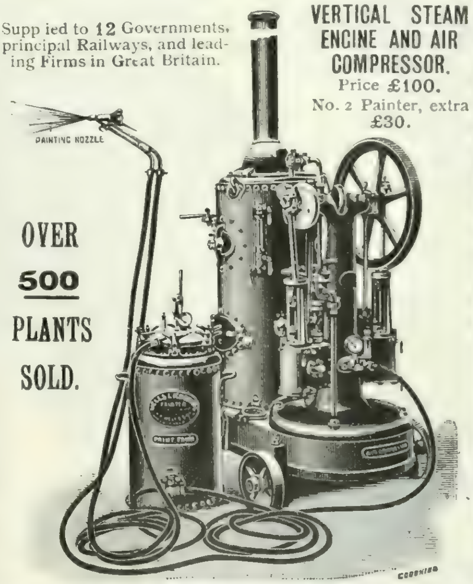

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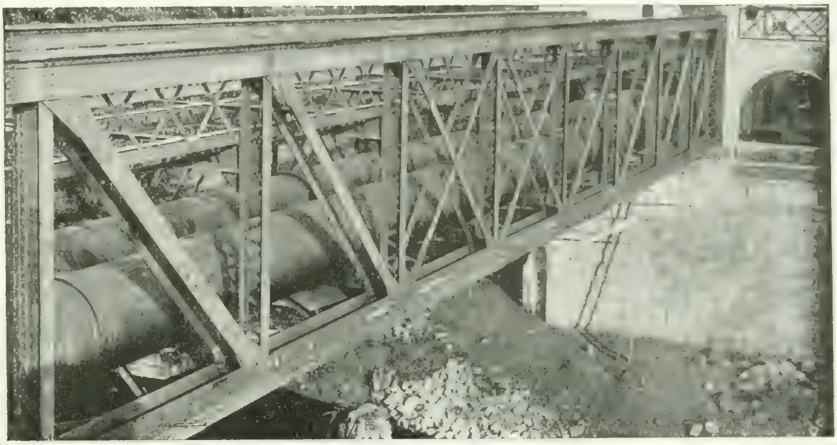

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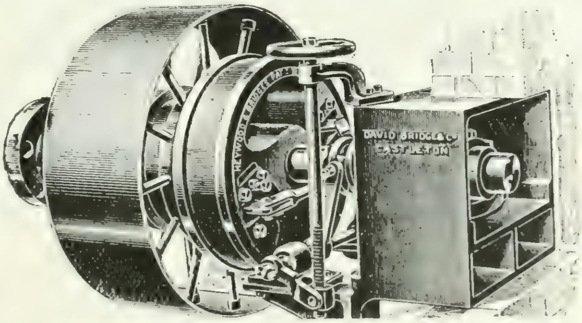

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Steel Wire Mining Ropes.

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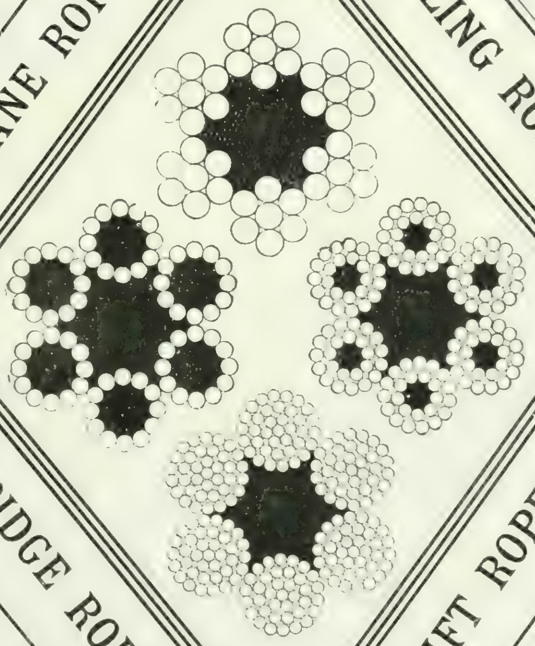

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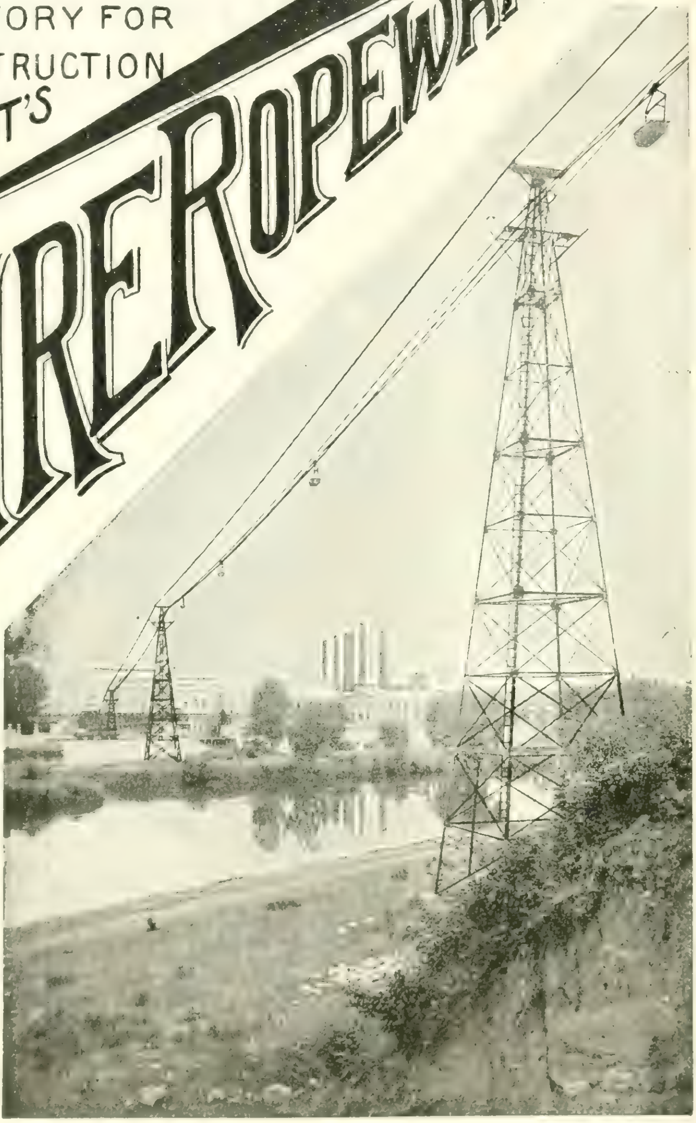

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Special Department for the Construction of

HOISTING & CONVEYING MACHINES, CRANES.

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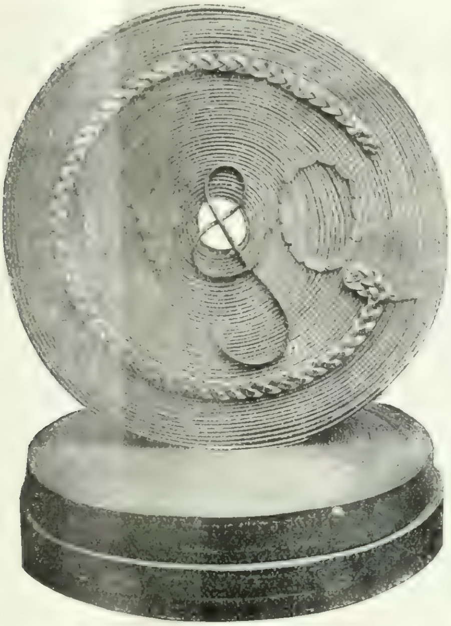

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The Best Industrial Pump in the World

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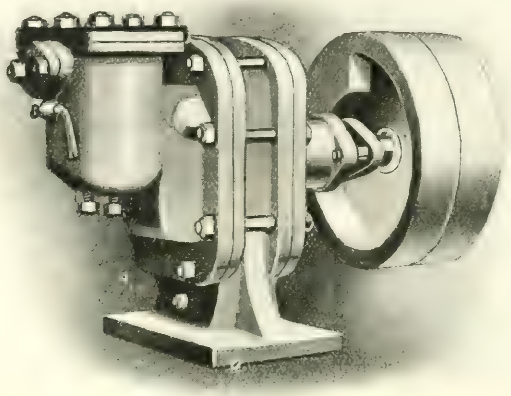

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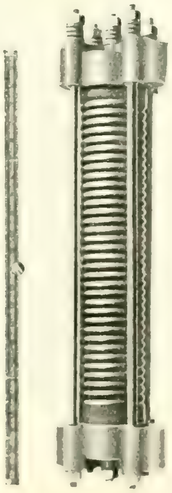

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"SPECIAL" DUPLEX
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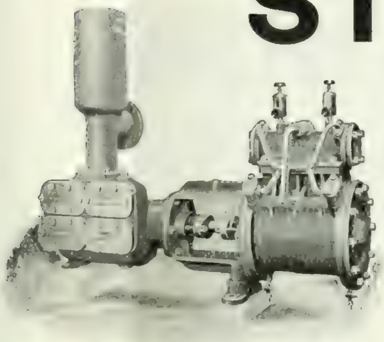

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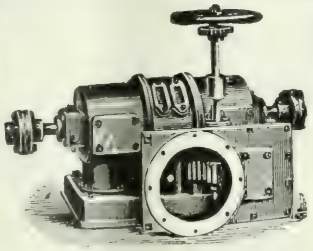

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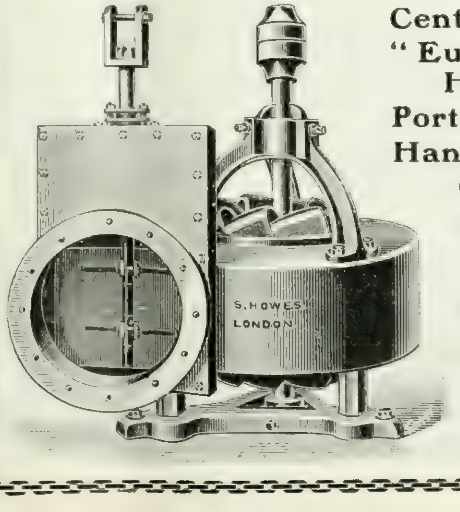

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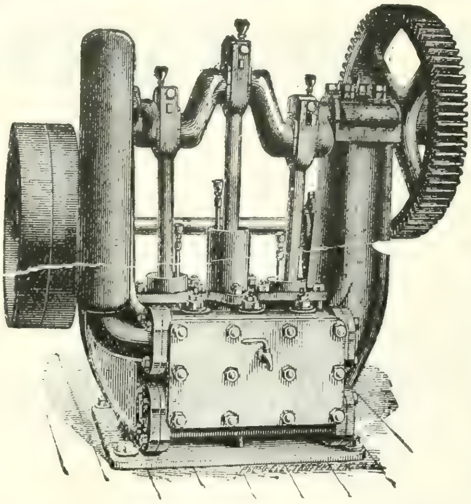

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Let me know the amount of water you require and I shall be pleased to quote.

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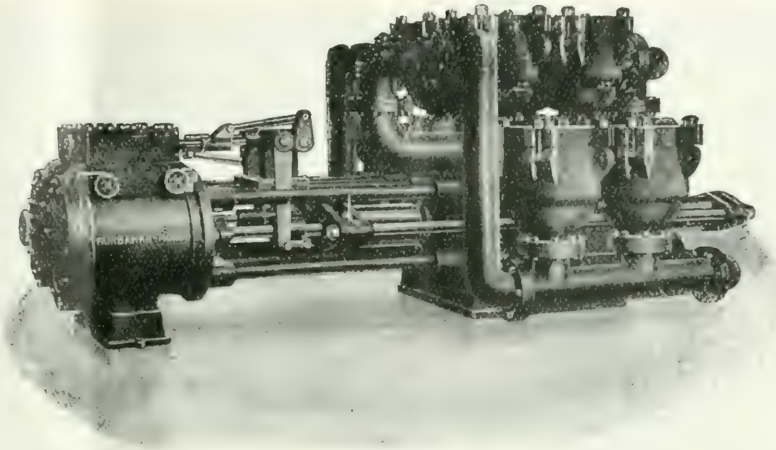

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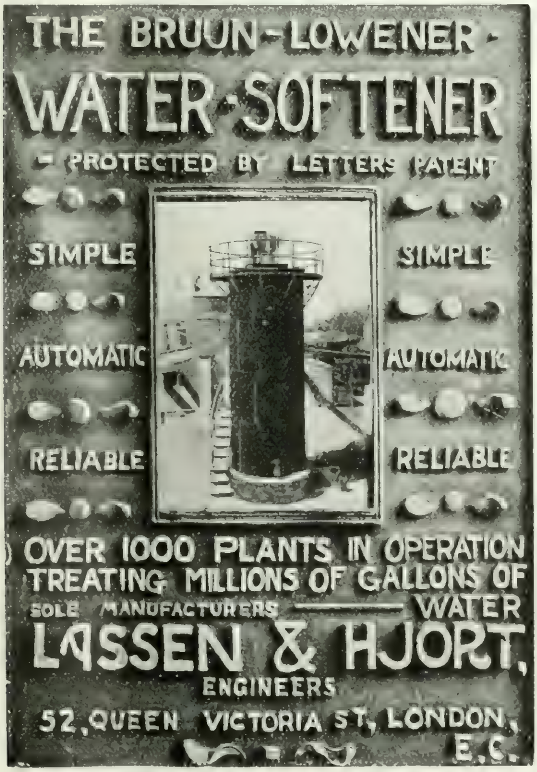

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PROTECTED BY LETTERS PATENT

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OVER 1000 PLANTS IN OPERATION
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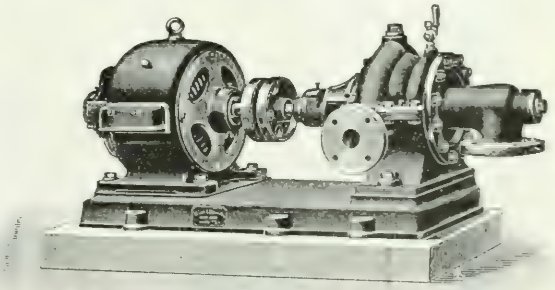

Made for any capacity, for all lifts, with highest efficiency, specially for direct coupling with Electromotors, also high-speed Electrical Plunger-Pumps for all services.

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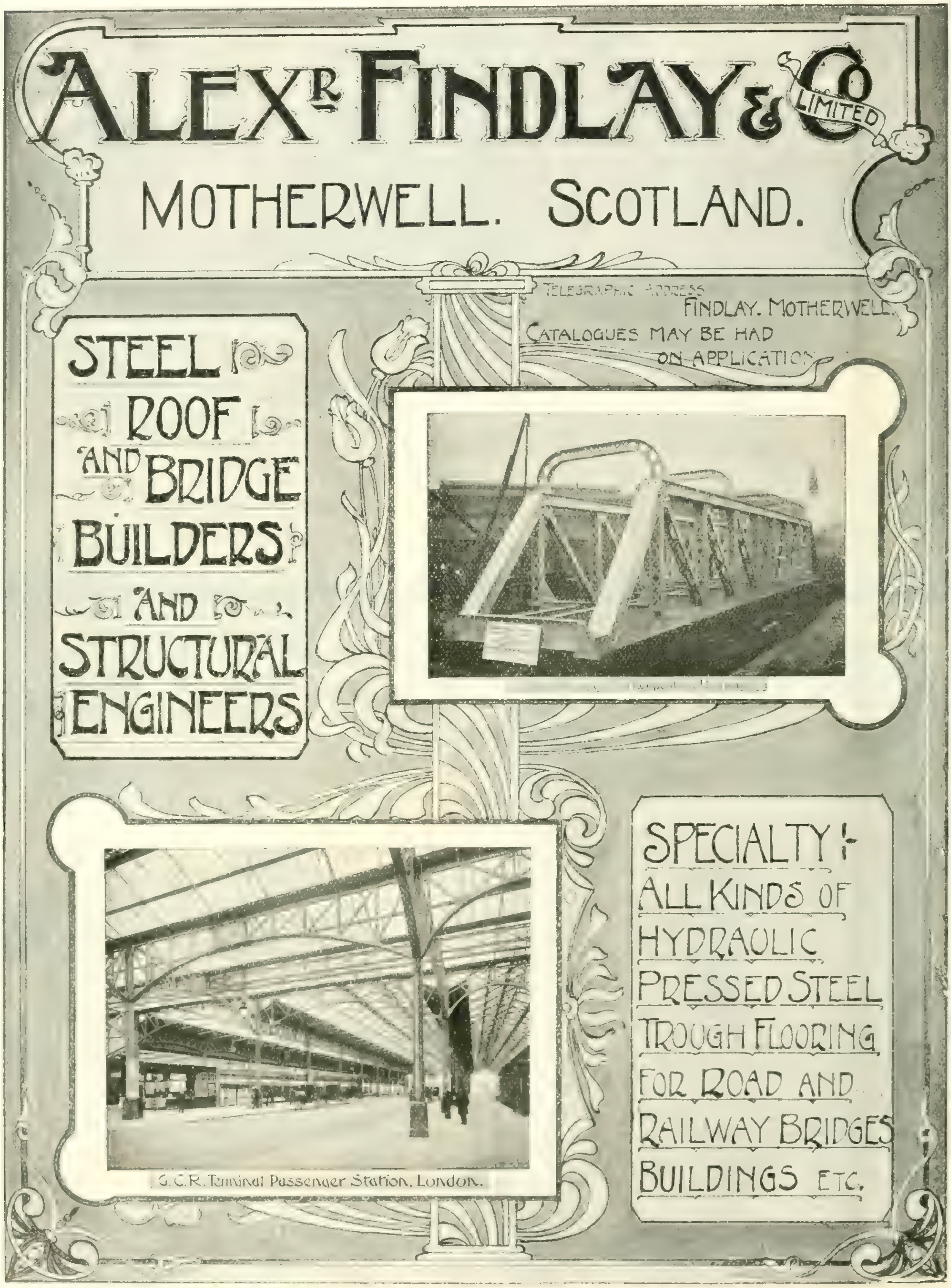

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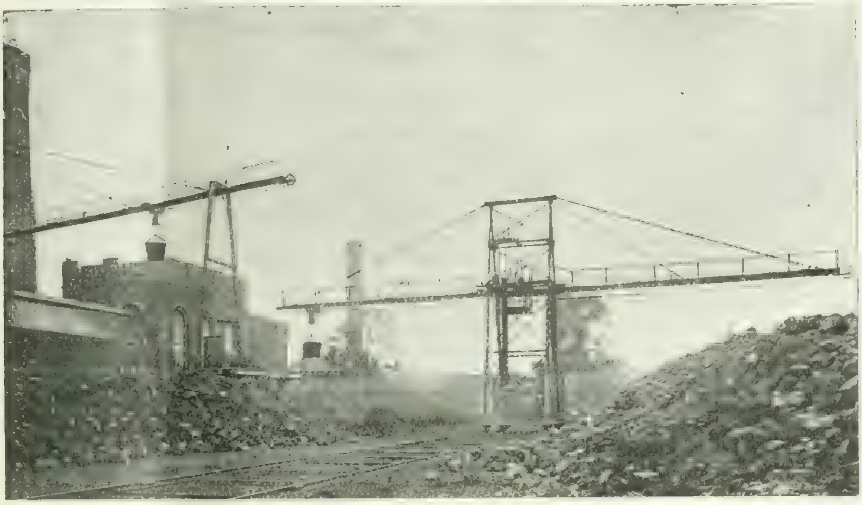

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For Rapid and Economical Handling of General Cargo, Coal, Ore, &c.

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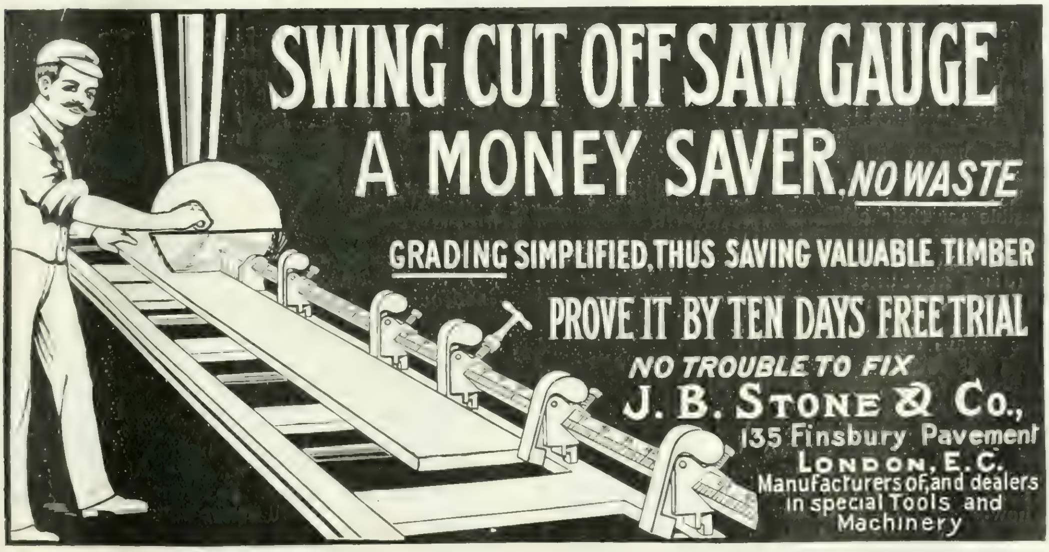

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The cost of production is an important feature in the counting house of every manufacturing concern, as charges and future estimates must be based on the record of such costs. Card systems, properly applied, give all this information with a minimum of clerical labour and a maximum of convenience that cannot be obtained with a book system, no matter how well devised. All the details being accessable at any time, without respect to each other, so that statistics of any kind may be gathered without difficulty or delay, using in many instances the original record and dispensing with the necessity of transcribing same.

QUOTATIONS—In and Out.

When a client refers to a quotation without indicating the date it was given; or if, when buying, it is desirable to consult quotations received, considerable difficulty is often experienced in locating the particular information desired. The card system will overcome this difficulty. By a method of cross-indexing the knowledge may be obtained either by date, name of article, or the name of the firm interested.

TRAVELLERS' RECORDS.

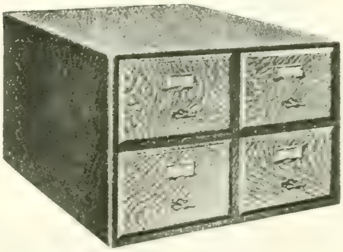
To supplement a traveller's efforts so as to help him to get all there is in his territory you must know what he is doing, who he calls on, when he is to call again, with any other details of interest. This information also enables the firm to keep in closer touch with their customers, to know if anyone is being neglected, and a new traveller can take up the work intelligently and without prejudice to his employer's interests.

STAFF RECORDS.

It is always desirable to know whom the staff consist of; where they live, where they came from, who they worked for, and various other details, for and against, of interest to their employers. The card system is particularly applicable to this purpose, as names can be filed in strict alphabetical order and are readily referred to. When anyone leaves, the name can be transferred to the past employees' file, without rewriting or scratching out the previous record, where it is accessable for reference in case of reapplication for a position or other purpose.

THIS CABINET

Properly and intelligently arranged, will contain all that information regarding the details pertaining to a business organization which it is necessary to have accessable to that guiding hand that is to direct it on to continued success.



OVERDUE ACCOUNTS

Are the bane of the manager and the cashier, the great difficulty being to dun the slow paying accounts without hurting the feelings of an otherwise good customer. This can be successfully accomplished by the use of the card index system, with the additional advantage of having all overdue accounts together and under the eye of the man responsible for their collection. One of our clients has reduced his outstanding accounts £10,000 per year by its use, and states that the system is responsible for increased purchases by these clients. We can show you how.

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How often goods are ordered in anticipation of early use, and delivery is promised at a certain date; through lack of a proper system the date of delivery lapses without attention from the purchaser and when the goods are wanted it is found, to the inconvenience of everybody concerned, and sometimes to the financial loss of the firm, that no delivery has been made. A very simple application of the card system will overcome this difficulty and enable the user to prevent any such delays, besides permitting him to keep in closer touch with his receiving department.

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How frequently orders are lost through inadequate attention is best shown by the experience of one of our clients, who stated that they secured 25% better results from their advertising through the use of the card follow up system than they had formally secured without it. We can apply this system to your needs so that you will derive equal benefits, whether you secure your business through advertising, circularizing or by traveller.

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"SIROCCO" AIR COOLING AND FILTERING APPARATUS.

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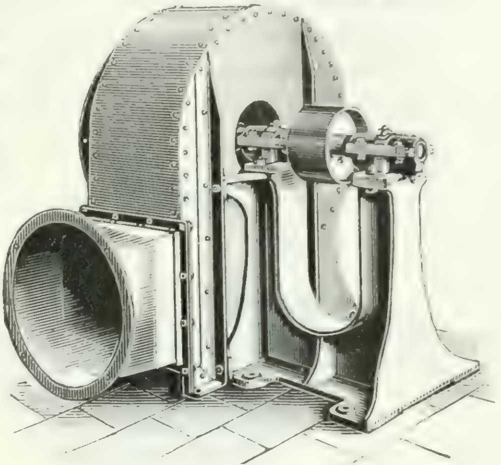

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which have for many years been recognised as

THE BEST & MOST DURABLE METALS

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Slide Valves, Bearings, Bushes, Eccentric Straps, and other parts of Machinery Exposed to Friction and Wear.

Also for Pump Rods, Pumps, Piston Rings, Pinions, Worm Wheels,

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Managing Director: F. H. NALDER.

Ammeters, Voltmeters, . .
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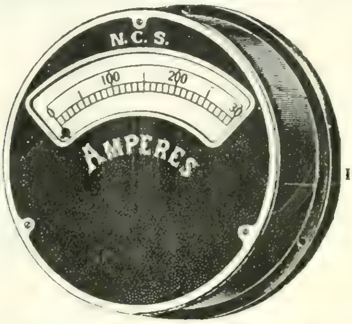
Switchboards. . . . .

Telegrams: "OCCLUDE, LONDON."



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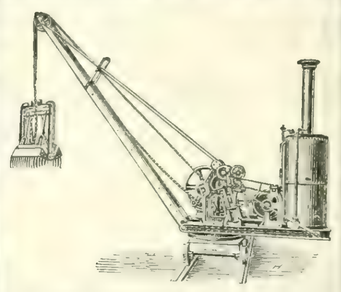

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Cogging Mills, Plate Mills for Armour Plates, Heavy and Fine Plates, Plants for the Manufacture of Tinned Sheet Iron, Girder and Rail Mills. Merchant Bar, Wire and Hoop Mills, Rolling Mills for Billets, Slabs and Sheet Bars, Pipe Mills, Universal and Special Mills.

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High-class LUBRICANTS

For Machinery of Every Description.

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Telegrams: "BLUMANN, LONDON." Telephone No.: 92 DEPTFORD.

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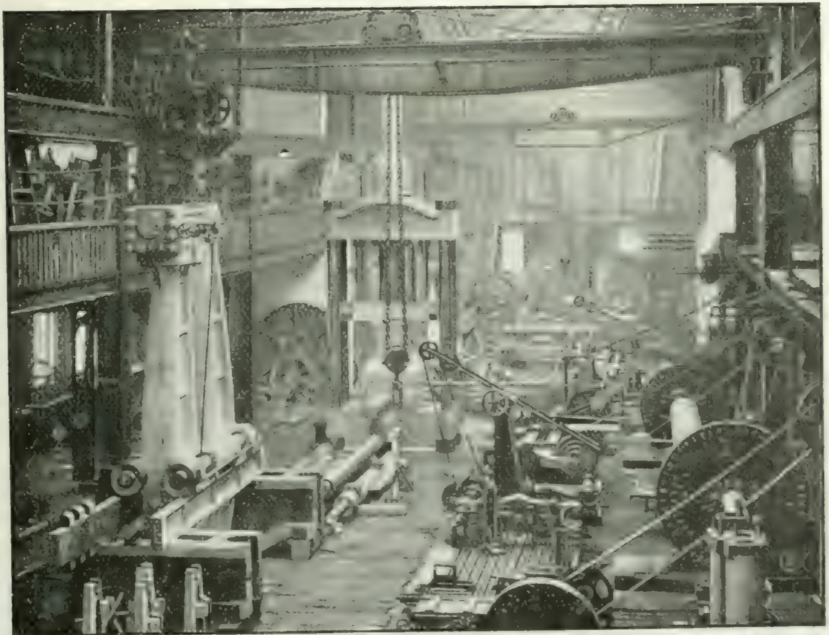
HENRY BERRY & CO., Limited,

LEEDS, ENGLAND.

MAKERS OF

- Belt-driven Pumps
- Duplex Pumping Engines
- Fixed Riveters
- Portable Riveters
- Accumulators
- Punching Machines
- Shearing Machines
- Forging Machines
- Flanging Machines
- Baling Presses
- Ingot Cranes
- Foundry Cranes
- Travelling Cranes
- Bloom Shears
- Billet Shears
- Wheel Clutting Machines
- Spoke Bending Machines
- Wheel Bossing Presses
- Wheel Presses
- Leathers
- Valves, &c.



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- Joggling
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- Gasholder Makers
- Boiler Makers
- Bridge Builders
- Ship Builders
- Wagon Builders
- Steel Works
- Docks, &c., &c.

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PAGE'S WEEKLY Ventilation, &c.

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Cyclone Fans
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Are not only Ventilating most of the Important Public Buildings throughout the Country, but have been adopted by the Principal Steam Ship Companies also.

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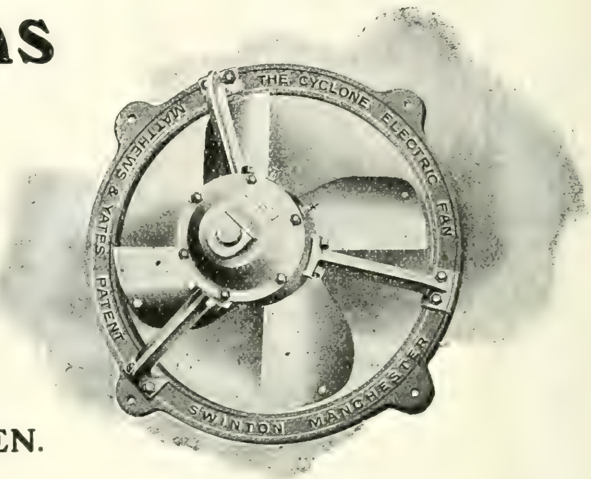
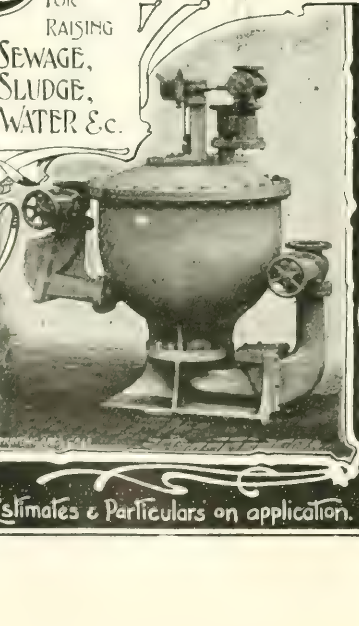


Cyclone Electric Fan. Enclosed Motor.

SHONE PNEUMATIC EJECTORS

FOR RAISING
SEWAGE,
SLUDGE,
WATER &c.



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COMPRESSED AIR LIFTS
for raising water from WELLS, BOREHOLES &c.

AIR COMPRESSING MACHINERY
FOR ALL SERVICES.

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47, VICTORIA STREET,
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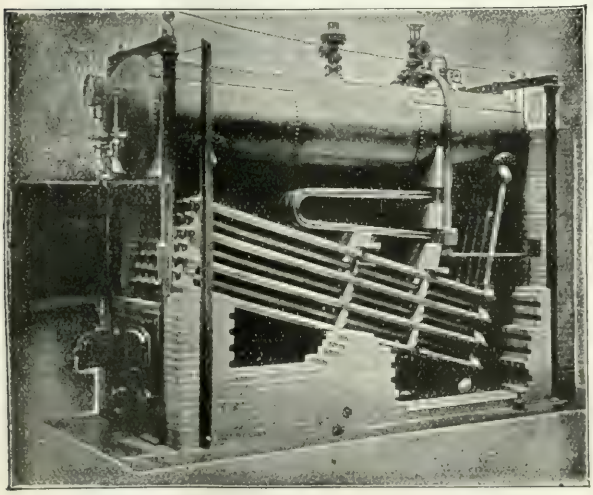

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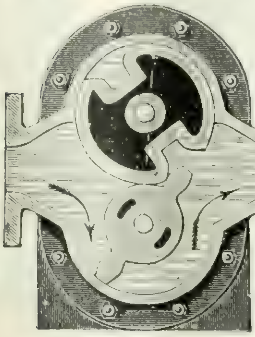

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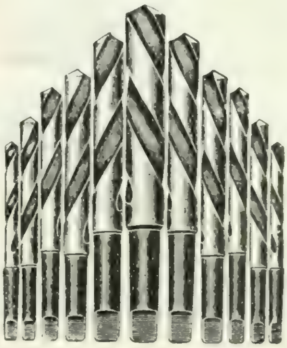

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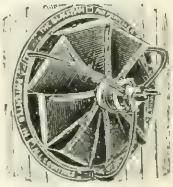

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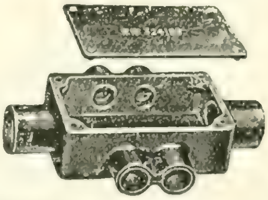

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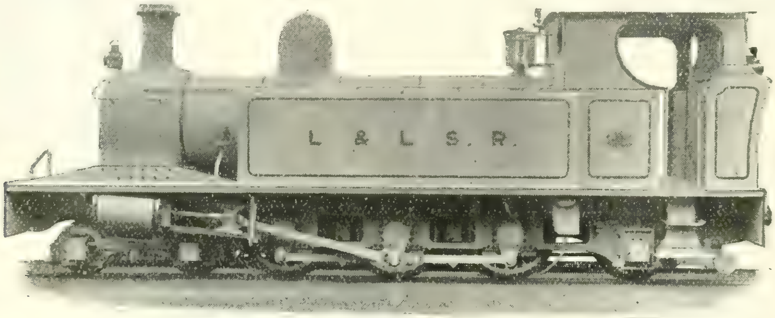

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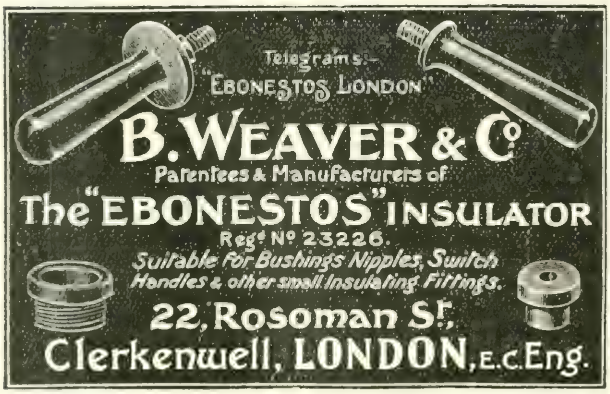

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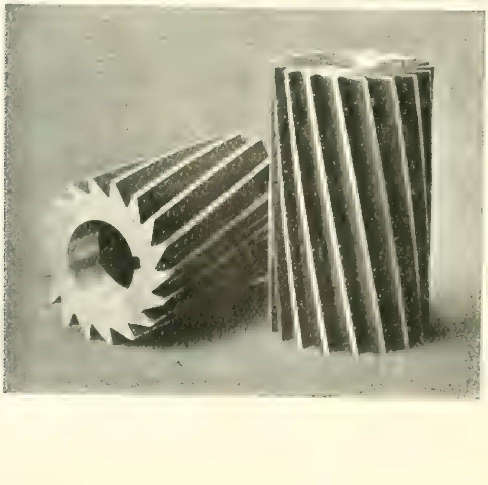

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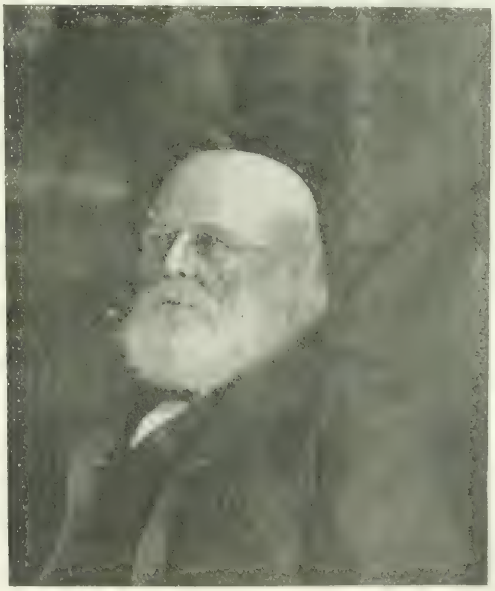
An Illustrated Technical Weekly, dealing with the Engineering, Electrical, Mining, Iron and Steel, and Shipbuilding Industries.

VOL. V. LONDON, FRIDAY, DECEMBER 23, 1904. No. 15.

The Offices of "Page's Weekly," Wednesday, Midnight.

BY way of preface to a few notes which I hope from time to time to lay before my readers on the subject of Power, I propose to invite attention this week to the properties of an article of British origin, a small sample of which lies on the table before me. It is a piece of coal—Welsh coal—and it weighs exactly one pound. So insignificant and valueless does it appear that none would stoop to pick it up in the street; and yet within it lies locked up, not only material power—the power which it is the engineer's province to handle—but, in a far broader sense, that Power which enables the country that gave it birth to dominate every sea with a British fleet. There is much to tell about this pound of coal. We live in the present, and with it are chiefly concerned. Our tendency is more to speculate in the future than to contemplate the past, but in whichever direction we look, we shall find that this pound of coal is, has been, and beyond reasonable doubt will be, a potent factor in the measure of prosperity granted to us as a nation.

It is not unfitting, before concentrating our attention upon the methods of utilising this gift of beneficent Nature to the human race, that we should spend a few moments in looking back over a vast interval of time to that remote period in the history of this planet when, upon a yet unformed earth, the light and heat of the sun laid up for us those gigantic forests which now exist as our coal-measures. It remains only for us to utilise to the best advantage this great store of potential energy, which, though vast, probably, beyond our conception, is not illimitable. The process of evaporating water by the combustion of coal is simply the transformation of energy through the action of chemical forces from the latent



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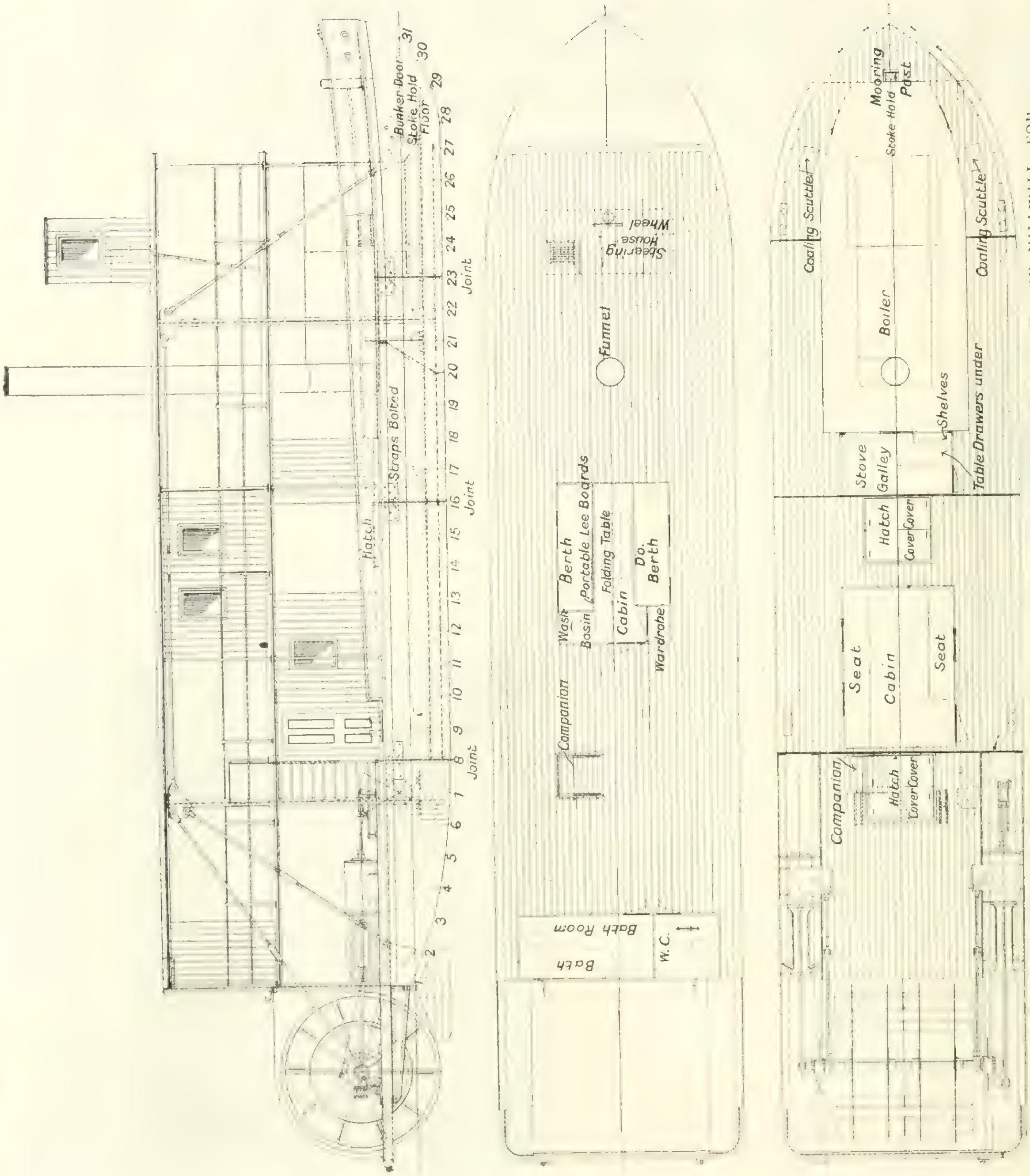
THE LATE SIR LOWTHIAN BELL, BART., LL.D., J.P., D.L.

Whose death occurred on Tuesday at Middlesbrough. (See *page* 930.)



PLANS OF TWO STERN-WHEEL VESSELS BUILT BY MESSRS. EDWARDS AND CO., LTD., OF MILLWALL, FOR MAIL SERVICE ON THE UPPER NILE.

into the sensible form, to be converted, by the apparatus of the steam engine, into equivalent mechanical energy.

The determination in the year 1849 of the equivalent, which will carry down to remotest generations the honoured name of Joule, established the fact that heat and mechanical work are convertible forms of energy, and measurable by the same unit—the foot-pound. That 33,000 foot-pounds constitute one horse-power, is as well known, probably, as that 1,760 yards make one mile, but the statement that 772 (I adhere to Joule's own figure) of the same foot-pounds, make one thermal unit, is not only nominally but actually true; for whereas the horse-power is simply a conventional expression, established in error, and only perpetuated for convenience, the determination of the number 772 as the equivalent of a thermal unit in foot-pounds is a profound scientific truth, and one of the brightest achievements of the nineteenth century.

The British thermal unit, usually spoken of as "heat unit," or B.T.U., is a quantity of heat—it is the measure of the heat expended in raising one pound of water at or near 32 deg., through one degree F. of temperature. Therefore, we may say that to heat one pound of water through 42.7 deg. takes one horse-power, because

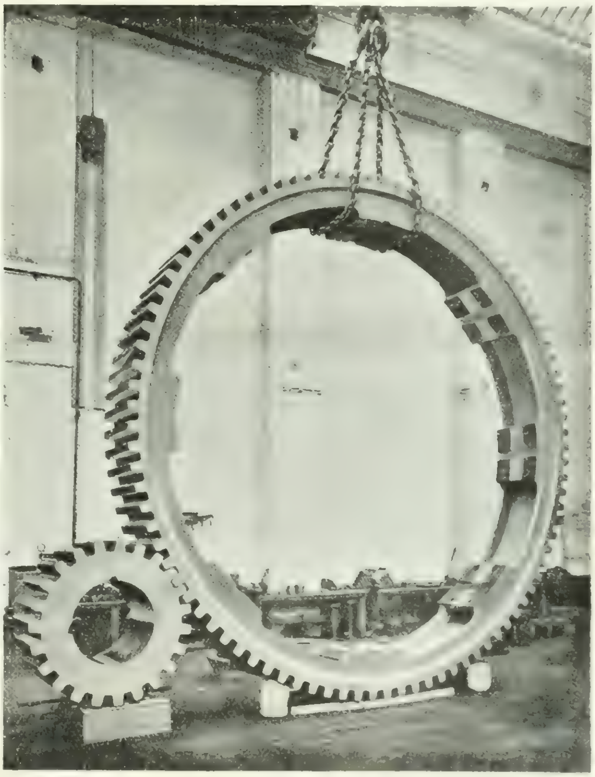
$$\frac{33{,}000}{772} = 42{\cdot}7.$$

One pound of good average coal may contain 14,000 B.T.U., and if, therefore, it were possible to utilise the whole of it, we should, for each pound of coal consumed, obtain nearly 5½ horse-power per hour. We shall see later on what is the best we can hope for under present conditions; for the moment we are concerned with the behaviour of our pound of coal when consumed, with others in the furnace of a steam boiler. The losses which in practice are sustained at every step may be summed up thus as regards the effective transfer of heat from the coal to the water in the boiler. The heat lost in the necessary production of a chimney draught; that lost by conduction, by radiation, and by imperfect combustion. The efficiency of combustion is expressed thus:—

$$\text{Efficiency} = \frac{\text{Furnace temperature} - \text{Chimney temperature}}{\text{Furnace temperature}}$$

all being calculated from the absolute zero of temperature, generally taken as—461 deg. F., or 493 deg. below freezing-point. Obviously then, our aim should be, in this as in all other operations involving the useful transfer of heat, to work through the greatest range of temperature possible.

The total efficiency of the whole apparatus of the boiler (which necessarily includes the



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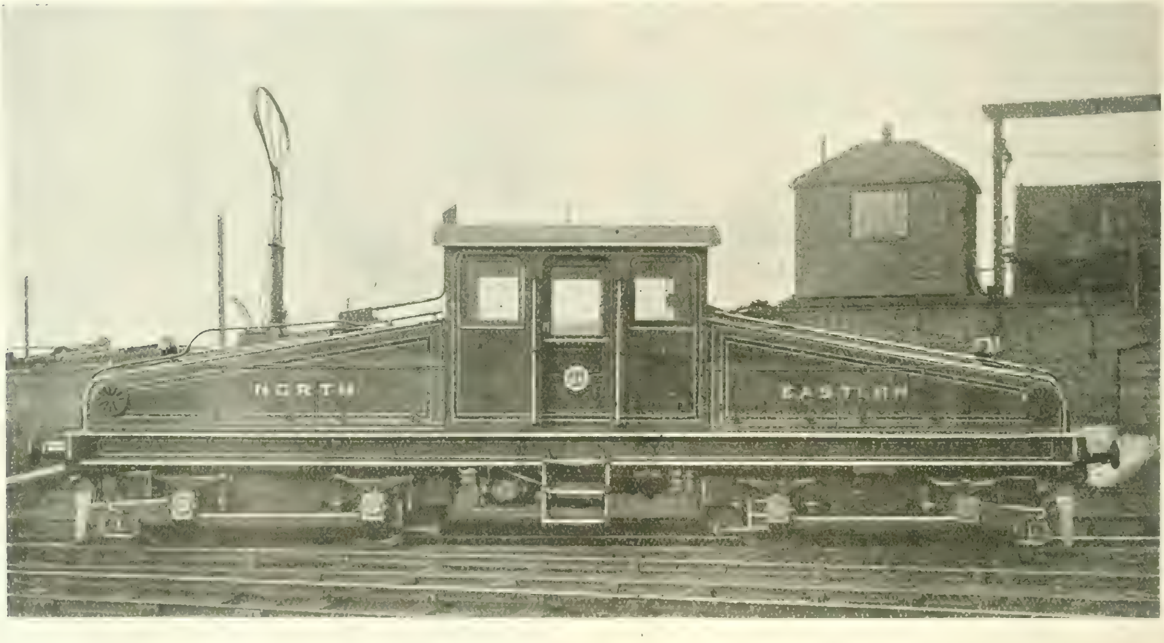
17 ft. 3¼ in. dia., 7 in. pitch, 30 in. wide, weight 21 tons. The steel forged pinion of 4 ft. 3¼ in. dia. was cut from the solid forging, the teeth being milled out.

personal efficiency of the stoker) is a fraction formed by dividing the actual quantity of water evaporated, by the evaporative power of the fuel. Thus, in one of the best performances of a steam boiler recorded to my knowledge, that of a Babcock-Wilcox boiler, fired by a Bennis mechanical stoker, the actual figures were:—Each pound of coal evaporated 9·95 lb. of water at 161·4-lb. pressure above the atmosphere. The ascertained value of the coal being 14,049 B.T.U. per pound, we have to find the number of heat units required to raise the temperature of 9·95 lbs. of water from 66·5 deg. the temperature of the feed water, and convert it into steam at 161·4 lbs. per square inch above the atmosphere. From tables of the properties of saturated steam we find the total heat of steam at 161 lb. pressure to be 1,195 B.T.U. calculated as from 32 deg., or 1,160·5 from 66·5 deg. Hence:—

$$\frac{1{,}160 \cdot 5 \times 9 \cdot 95}{14{,}049} = 82 \cdot 2$$

and this figure, 82·2, is the percentage of total efficiency of the boiler. This fine performance is, of course, largely contributed to by the continuous firing of the mechanical stoker, by which the furnace temperature is kept at the highest possible. With the super-heater in use (154 deg. above the steam heat) the total efficiency amounted to 87·46 per cent. If our steam engines were as efficient in using the steam as our boilers are in producing it, we should have very much better results to show than are now possible.



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Length over buffers	37 ft. 11 in.	Diameter of wheels	3 ft.
Pivotal centres of trucks	20 ft. 6 in.	Diameter of axles at centre	6½ in.
Wheel base of each truck	6 ft. 6 in.	Diameter of axles at journals	6 in.
Width over cab	7 ft. 6¼ in.	Length of journals	10 in.
Width over side soles	7 ft. 10½ in.	Weight in running order	50 tons.

NEWS ITEMS.

Sir Wm. White on his Visit to America.

Acting on the excellent hint thrown out by Sir George Bruce the Council of the Institution of Civil Engineers have arranged for Sir William White, to deliver an address to the members on "The Recent Visit to the United States and Canada." The date fixed is January 10th, and the address will be repeated on the following day. The popular Past-President should have an interesting story to tell of transatlantic experiences, for Sir William is not only a keen observer, but a born narrator.

Theatrical Engineering.

The London Coliseum, which is to open its doors to-morrow, has been visited by a representative of Page's Weekly, who has inspected the many engineering details. What has attracted most attention in technical circles is the arrangement of revolving stages. These are three in number, arranged in concentric rings, the outer one and the intermediate being 12 ft. across, and the middle circle 25 ft. 7 in. The entire diameter across the three is 75 ft., and so accurate has been the building up that only 1 in. of clearance is necessary to permit of the tables running separately, without rubbing or touching. The tables are built up on rolled steel underframes 9 ft. high, and instead of the motive power and wheels being on the carriages as in a tramway, the engineer has designed a runway on the underframes, which runs on the motors, thereby reversing the usual order of things and securing considerable lightness, absence of moving contacts for the current, and a very great reduction in the noise. The rings or stages can run in either direction as separate pieces, or can be locked together for combined effects, and, though each has its own set of motors, they are combined for purposes of heavy work.

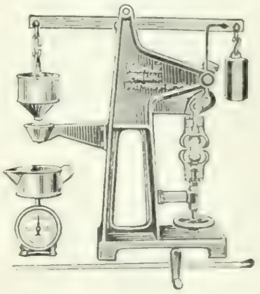
Motor-driven Revolving Stages.

The electric motors, 14 in all, used for driving the stages are all set on adjustable beds for levelling up to the level of the fixed, or permanent, stage surrounding three outer rings, and the motors are all controlled from the special switch pillars on a raised gallery on the prompt side of the stage which overlooks every part of it. The signalling to the drivers is effected by means of a special form of ship's engine-room telegraph, worked from a position on the stage level, where the stage manager has also to hand speaking tubes, lamp-signal keys, and telephones to all the points where engineers are stationed to work the numerous electric apparatus. On receiving a signal on the dial the table driver has only to turn to his controller wheel and the vast table, 75 ft. in diameter, can be turned, stopped and reversed, the actual controller or switches being in a chamber below the stage. These controllers are over 5 ft. 6 in. in height, and are the largest series of parallel controllers ever made.

A New Standard Automatic Cement Tester.

The accompanying illustration shows the Riehle U.S. Standard 1000 lb. (500 kilos) Automatic Cement Tester, which is constructed entirely of metal and is the outcome, we are assured, of very exhaustive experiments.

The beam is brought to a balance by pouring shot into the cone-shaped bucket on the left of the machine, thus counterbalancing the weight on the right-hand side of the machine. The test briquette is then placed in the grips and by means of the handwheel under the lower grip, the slack is taken up. A piston valve (patented November 8th, 1904) in the bucket is then lifted and the shot flows out of the bucket, causing the weight to overbalance the bucket and load thus to be applied to the specimen. When a sufficient weight of shot has flowed out of the bucket, the unbalanced force of the weight is sufficient to break the briquette, and then the lightened bucket is jerked by the weight and the piston valve is closed, thus causing the flow of shot to cease.



The weight of shot which has flowed out is the measure of force required to break the briquette, and this shot is caught in a scoop on a scale which is graduated to read directly the stress on the briquette.

If at any time the briquette should be so yielding as to allow the beam to strike the lower buffer before the briquette is broken, the valve automatically closes and the flow of shot ceases. Then, if desired the beam can be raised by means of the worm and wheel and the test continued.

If it is desired to make a test of extreme accuracy the beam may be kept horizontal during the test by means of the crank and worm-wheel. In place of the spring balance, any form of scale may be used.

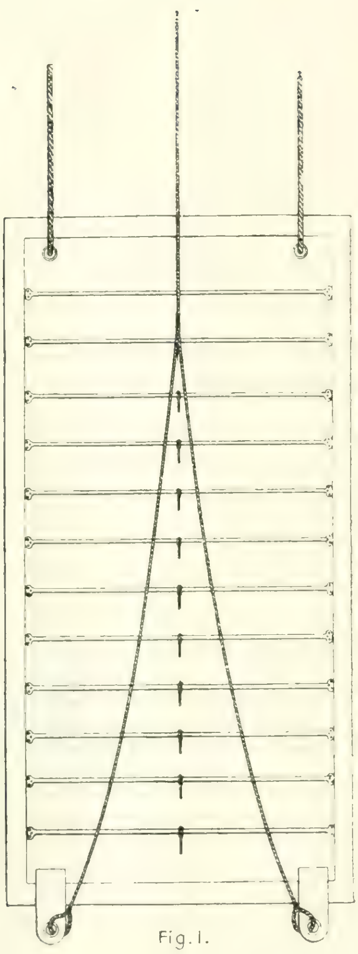


Fig. 1.

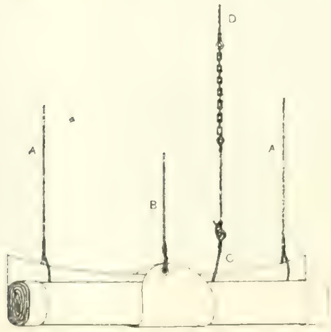


Fig. 2.

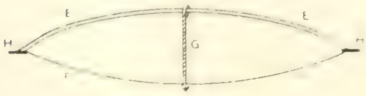


Fig. 3.

COLLISION MAT BY MESSRS. JAMES SPEEDING AND CO.

The solid-back cement testing grips patent has been designed in order to avoid the spreading of the grips during the process of testing.

The weight of shot in the 1,000 lb. machine is as 1 lb. to 100 lb., *i.e.* 10 lb. of shot on an ordinary scale would indicate a strain of 1,000 lb.. A 2,000 lb. machine is also made, the proportion in this case being 1 lb. to 80 lb.; in other words, 25 lb. of shot will indicate a 2,000 lb. strain.

These machines are being made by the Riehle Brothers Testing Machine Company, of Philadelphia.

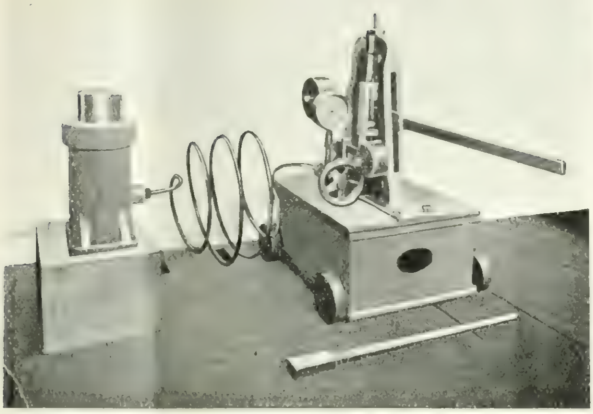
Professor H. S. Hele-Shaw.

Professor H. S. Hele-Shaw, whose work in South Africa we have from time to time chronicled, will early in the new year take over permanent duty as Principal of the Transvaal Technical Institute. The buildings, which it is hoped will shortly become the Transvaal University, are situated in Plein-square, Johannesburg, where are also in course of erection a library, museum, art gallery, and other public halls, the whole forming a group which, when completed, will be one of the finest in the world.

A New Collision Mat.

The collision mat illustrated in the adjoining column has recently been under trial at Portsmouth. It is designed to place and hold in position a strong canvas covering over the damaged part of a ship, and is composed of two thicknesses of canvas, across which are placed horizontally, galvanised grooved iron bars 15 in. apart. The ends of the bars are fastened to the mat by copper rivets, and to the middle by ties, allowing a play of 15 in. Around the outside of the mat is a strip of stout fustian 6 in. in width which, when wet, tends to grip the side of the ship. The mat measures 7½ ft. by 15½ ft., but when rolled up in readiness for use it measures only its width, *i.e.*, 7½ ft. by 15 in.

Round the rolled-up mat is a canvas apron secured by a slip knot. A jerk on the rope securing the apron releases the knot and allows the mat to unroll freely down the side of the ship and over the damaged part. To each corner of the bottom of the mat, a tail rope is also fastened, bridle fashion. This, after the mat is in position, is passed under the ship's bow or stern by means of a weighted messenger rope and is secured on the opposite side. When in use the pressure of the water causes the canvas to bulge inwards, and at the same time the strain causes the bars to bend outwards till the space between the centre of the bars and the mat reaches 15 in., when further bending and bulging is stopped by means of the ties. The new mat is made by Messrs. James Speeding and Co.



BOILER FLUE APPARATUS. BY MESSRS. RICE AND CO. (LEEDS), LTD.

Boiler-Flue Apparatus.

The accompanying illustration shows an apparatus specially designed by Messrs. Rice and Co., for pushing up boiler flues. It sometimes occurs that through shortness of water or other causes the internal flue of a boiler partially collapses or bulges inwards in places. In such cases if the plate be intact, the flue can be restored to its proper shape and made sound again without the necessity of cutting out the damaged portion or disturbing the boiler, or even heating the plate, unless the bulge is extensive. The apparatus in question consists of an hydraulic cylinder of special design and material, made as light as possible so as to be easily handled and provided with a suitable hand pump. A hard wood block, curved to the radius of the flue on one side and flat on the other is placed in the flue opposite the damaged place. The cylinder is then mounted on the top and connected by means of the flexible coil of pipe to the hand-pump, and pressure applied until the bulged portion of the flue is pressed out to its proper shape. The cylinder and ram can be got into a flue of 24 in. diameter, and is capable of dealing with plates up to $\frac{3}{4}$ in. of thickness cold. The hand-pump is mounted on wheels so as to be readily moved about, and the whole forms a handy and portable arrangement for dealing with damaged flues in any position.

The plans on page 902 show two sternwheel vessels built by Messrs. Edwards and Co., Ltd., of Millwall, London, to the order of the Soudan Government.

These vessels are 60 ft. long (length of hull), 71 ft. long over all, by 15 ft. 3 in. beam, and the draught of water in the loaded condition, 2 ft. 6 in. They are to be used for the mail service, on the upper parts of the Nile and have been built in four floatable sections, which can be put together or taken apart in the water, watertight bulkheads being arranged for this purpose.

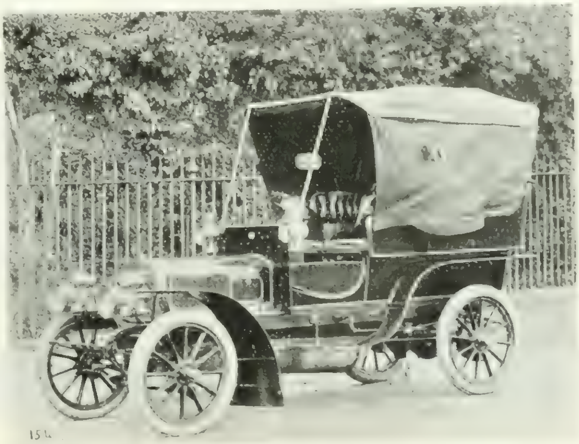
The steering is operated from a house on top of sun deck with chains and rods led to the tillers aft, there being two balanced rudders fitted to enable the vessel to steer quickly and easily.

Powerful horizontal compound surface condensing engines have been supplied, which obtain their steam from a locomotive type boiler, having very large grate area for using wood fuel. The machinery fitted is capable of driving the vessels at 11 miles an hour. The vessels have been built under the inspection of Mr. W. J. Harding.

Messrs. Thornycroft's latest Standard 20-H.P. Car.

The motor-car illustrated at the foot of this column is one of Messrs. Thornycroft's standard 20 h.p. cars, having four cylinders, 4 in. diameter by $4\frac{3}{8}$ in. stroke. Transmission is through a gear-box of the usual pattern, of the firm's special design, and by means of a propeller shaft to the differential gear on a live back axle. No chains are employed, and the gear is so arranged as to give a direct drive on the top speed.

The whole of the clutch and gearing is protected by a metal apron underneath. The clutch is of the lubricated multiple disc type. The engine is so designed that the bearings may be examined and adjusted without removing the cylinders or disturbing the engine in any way. In this type, the inlet valves are automatically operated. The control of throttle and ignition is arranged in a neat box on the top of the steering pillar. The body is of the Tonneau type, the canvas-hood being removable.



20-H.P. STANDARD CAR BY MESSRS. THORNYCROFT.

Combined Locomotive and Van for Lagos Steam Tramways.

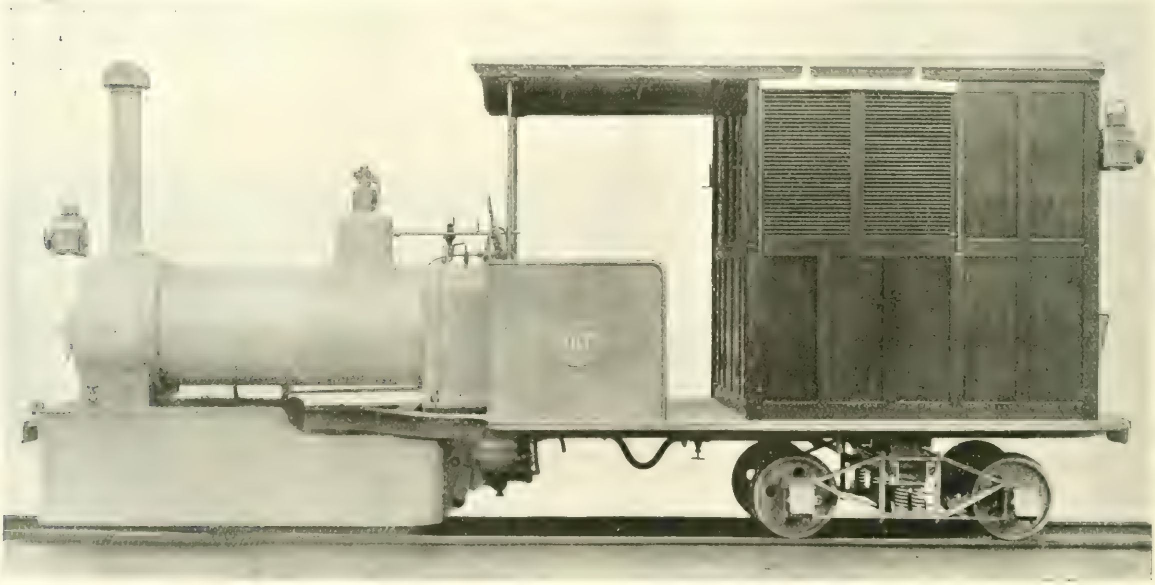
THE type of engine illustrated below have been supplied by The Hunslet Engine Company, Ltd., Leeds, for the Lagos Steam Tramways. They were designed and constructed under the instructions and supervision of Messrs. Baker and Shelford, consulting engineers to the West African Government Railways, Westminster, to meet and comply with the special circumstances under which they have to work. They are employed in light tramway traffic between the island of Lagos and the mainland, and have to cross the Lagoon by the "Carter" bridge, which was designed for foot passengers and light vehicular traffic only. As the bridge is 2,000 ft. long the question of strengthening it to carry an ordinary tramway could not be entertained owing to the cost. It was therefore necessary to design the engines and cars to suit the bridge. The engines in question are 20 ft. 10 in. long over buffer, and as their weight in full working order is only 5 tons 16 cwt. each, their distributed weight on the bridge is equal to about 5½ cwt. per foot run.

The cylinders are 6¼ in. diameter and 8 in. stroke, and drive four coupled wheels 1 ft. 6 in. diameter, coupled wheel base 3 ft. The valve gear is of the "Walschearts" type, entirely outside the frames, but screened from view and protected as the line runs through the public streets.

The boiler is of the Loco "Belpaire" type, specially designed for lightness and accessibility for repairs, etc. The working steam pressure is 150 lb. per square inch.

The van made of teak is carried on a steel frame or platform; the front end of the latter is connected by a yoke frame to a pivoted bearing fixed in the centre of engine frame and between the coupled wheel base, allowing perfect freedom of motion between engine and tender bogies when on curves. The yoke frame can be quickly disconnected if the Loco is needing to go into shed.

These engines haul two or three trailer cars according to the needs of the traffic, and have proved very satisfactory for their work. They are equipped with all the usual locomotive fittings.



COMBINED LOCOMOTIVE AND VAN FOR LAGOS STEAM TRAMWAYS.

Improvements in the Mechanical Charging of the Modern Blast Furnace

MR. DAVID BAKER, in the course of a contribution to the American Institute of Mining Engineers, says he is convinced that to hold the furnace manager responsible for the relatively poor work of the modern blast-furnace would be a great injustice, for its management has received much more study and care than was given to the older types.

The modern stack, he says, tends to work irregularly; slips are too frequent and too much "off" iron is made; the furnace "swings" too often and too much. He thinks it is this irregular working that causes the greater fuel consumption. When a furnace begins to work irregularly, one of the first things to be examined in searching for the cause is the distribution of the stock on top.

Furnace managers have been perplexed as to the cause of the rapid destruction of linings in modern blast-furnaces. An effort has been made to overcome this by placing cooling plates in the lower part of the in-wall, the excessive wear being often first manifested at a point 15 or 20 ft. above the top of the bosh.

I do not believe, continues Mr. Baker, that this excessive wear can best be prevented in that way. To my mind, the working hot on one side of the furnace indicates an interior condition calling for more than external remedy.

In my experience I have found that wherever the filling gave a column of lumps on one side of the furnace, at that point the wall would cut away. Some years ago the blast-furnaces of the Maryland Steel Company were filled by a car-system which dumped a ton of ore in a conical pile at four equi-distant points on the hopper.

When the first furnace filled by this method was blown out, the in-wall was found to have been cut into rectangular shape; the corners of the rectangle being directly under the equi-distant points between the piles of ore in the hopper. It was at these points that the lumps rolled, forming four chimneys of coarse stock in the furnace, through which the gas channelled. It is needless to add that the furnace work of this stack, before blowing out, was decidedly unsatisfactory.

From a faulty distribution comes a great train of evils. Correct the distribution and diminish the breakage of coke, and the modern stack will do better work in every particular than the older hand-filled furnace, yielding a fair return obtained for the money invested in labour-saving appliances.

After long investigation of the mechanical filling of blast-furnaces, I am satisfied it is impossible to obtain a satisfactory distribution of the stock with the double-bell charger and dumping-skip, however varied with deflectors, adjustable chutes, reducing-hoppers, or any other mechanism depending for adjustment, etc., upon an operator.

In searching for some means of duplicating hand-filling mechanically, I concluded that, since the skip could not readily be rotated about the furnace-top

FIG. 1

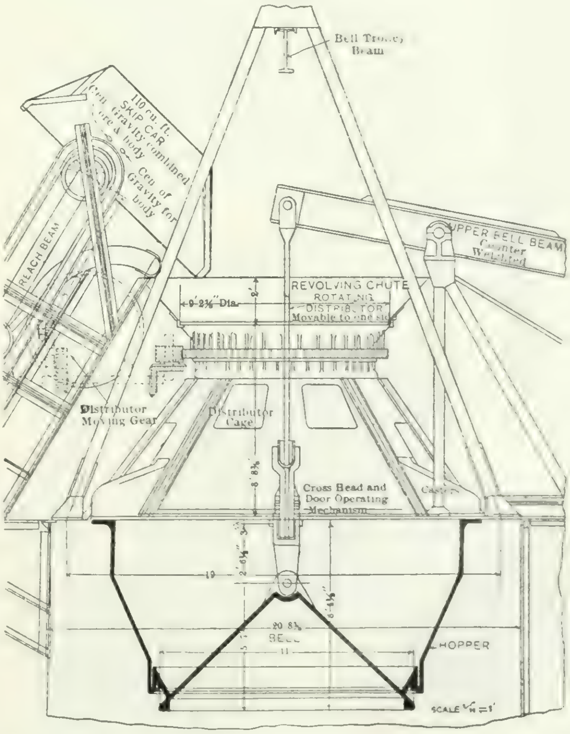


FIG. 1. SIDE ELEVATION OF DISTRIBUTOR AND SINGLE SKIP WITH A DOUBLE BELL-ROD.

like the barrow in hand-filling, we must try to rotate the furnace-top so as to produce the same effect—in other words, obtain the advantages of hand-filling and avoid its disadvantages, by making an automatic arrangement, working in unison with the skip-hoist, and not dependent upon an operator.

The top invented some years ago by Alex. E. Brown, of Cleveland, answers all these conditions. Here a revolving-hopper is operated by the skip-hoist rope-wheel. This hopper, provided with a wide chute, is moved into position while the empty skip is descending; a ratchet-arrangement in the drive preventing any movement in an opposite direction. This device, which may be used with single or double skip, directs each skip-load into a different section of the hopper. For instance, the coke-charge may be sent up in four skips, and deposited in four equi-distant parts of the hopper, thus making, owing to the wide discharge-nozzle, a complete ring of coke in the hopper. After the coke has been lowered into the furnace, the ore and limestone are sent up in the next four skips, thus making a complete ring of ore and limestone in the hopper. Now, to make this arrangement even better than hand-filling, this hopper, instead of moving just 90 deg. between skip-loads, is moved, say, 4 deg. more, so that the material of one charge is dumped in a slightly different place from the same material in the preceding charge. Thus, if eight skip-loads make a complete charge, the first ore of one charge will be dumped at a point 32 deg. from that of the first ore of the preceding charge, and so on. It is this indeterminate feature of the distribution which makes the apparatus valuable.

Fig. 10.

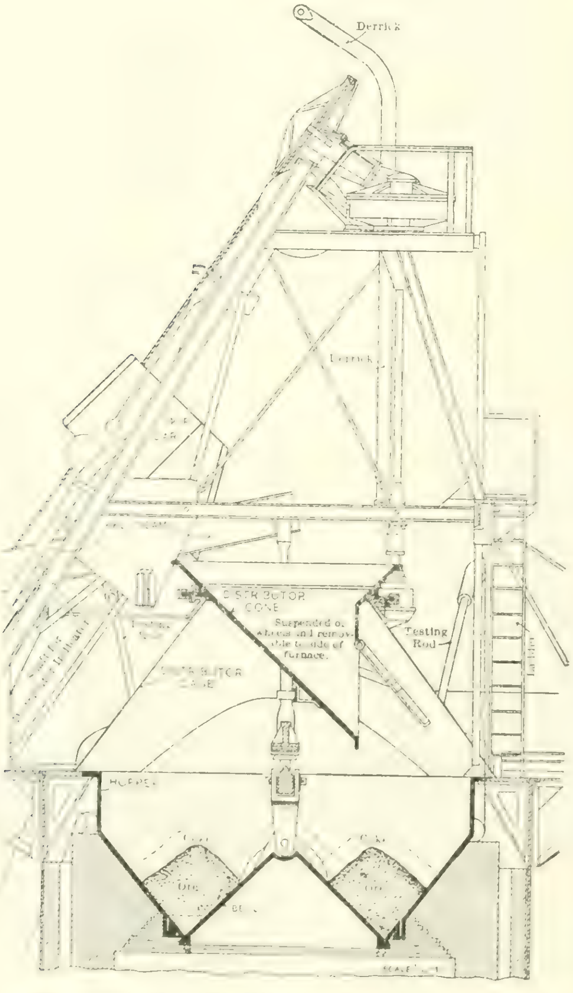


FIG. 2. SIDE ELEVATION OF DISTRIBUTOR AND DOUBLE SKIP.

The breakage of coke or ore is relatively small; for the hopper chute is kept as close to the main hopper as possible, and this distance may be cut down below 10 ft.

This charger was patented before the mechanical filling of blast-furnaces became the general practice; and the furnace managers of that day, while recognising almost universally the theoretical value of Brown's invention, thought it involved too much mechanism for a blast-furnace; and the double-bell, by virtue of its simplicity, became the most common type. Now, however, the serious defects of the double-bell charger have been demonstrated, while on the other hand Brown's device has been simplified. Fig. 1 shows its present form for the single skip, with the double-bell rod. The whole of the gas-seal and distributor is on wheels, and can be jacked up and run to one side, as shown by dotted lines in the figure, when repairs must be made to the main bell-and-hopper.

The gas-seal door is open, except when the bell opens. Then the first three inches of travel of the main bell allows the door to drop shut, and the top is sealed. During charging, the door, being open, allows the stock to flow freely out of the chute, and gives a more uniform distribution in the main hopper.

Fig. 2 shows the distributor applied with the double skip. No superstructure is required over the top of the furnace except what is necessary to handle the bell for repairs.

Fig. 3 shows the revolving hopper or chute removed from the gas-seal cage and support.

Fig. 4 shows the gas-seal cage, which is made of reinforced steel plate in this case, but is sometimes made of cast-iron where preferred.

In the earlier forms the revolving hopper was supported on wheels, and later on steel balls. In the

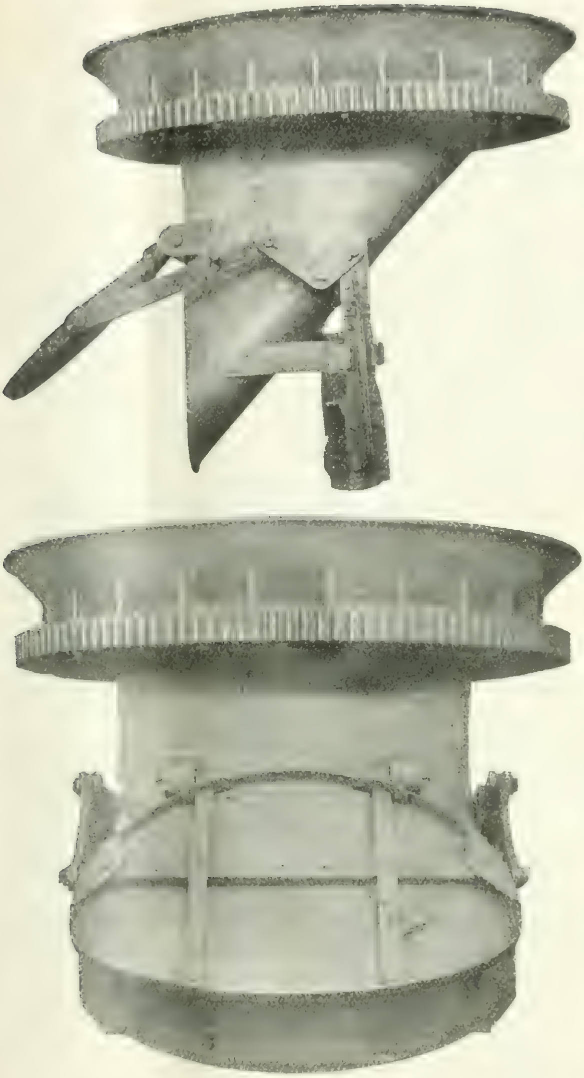


FIG. 3. REVOLVING HOPPER.

present form all these are dispensed with, and the flange of the hopper simply slides at the top of the gas-seal, on a surface of cast-iron against cast-iron, about 8 in. wide, and lubricated only with graphite. This arrangement, contrary to prediction, has been found to show practically no wear after a year's use. If they will last through a blast, the arrangement will have served its purpose well; and it seems, under actual trial, to be entirely capable of that degree of durability.

The flue-dirt does not seem to enter the joint to any extent. I believe the reason lies in the fact that the gas-seal door is only closed when the main bell is open. The pressure on the sliding surfaces is only about 10 lb. per square inch, and the friction under that load cannot be great.

This distributing-top has passed beyond the experimental stage, and has shown itself in practice to possess the advantages, without the disadvantages, of hand-filling. In all the furnaces where it has been installed, it has reduced the slips and prevented the irregular wear of the in-wall. There are indications that it will show a marked saving in fuel; but the data for comparison in this respect are not yet sufficiently complete for publication.

If the present prospect of technical efficiency should be confirmed by longer use, only one further improvement will be required to secure results superior in economy to those obtained by hand-charging—namely, an arrangement of bins and apparatus for handling coke, which will do away with the excessive production of dust involved in present methods of storage and rough handling and re-handling of this fuel.

Among other papers which have reached us from the American Institute of Mining Engineers are:—Evidences of Plication in the Rocks of Cananea, Sonora (W. P. Blake); Notes on the Flow of Gas from Orifices (W. R. Crane); Crushing in Cyanide Solution, as Practiced in the Black Hills, South Dakota (C. H. Fulton); Cyanide Practice at the Maitland Properties, South Dakota (J. Gross); The Equipment of a Laboratory for a Smelting-Plant (H. Haas); The Genesis of the Copper-Deposits of Clifton-Morenci, Arizona (W. Lindgren); A Geological Cross-Section of the Western Cordillera along the Rio Huasco (S. H. Loram); Biographical Notice of Sir Clement Le Neve Foster (Rickard); Refractoriness of Some American Fire-Brick (F. R. Weber); and Special Forms of Blast-Furnace Charging-Apparatus (Witherbee).

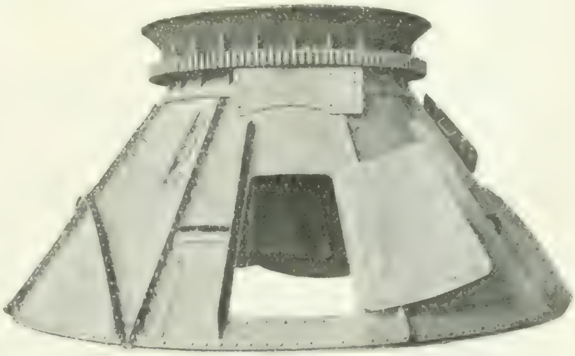


FIG. 4. SIDE VIEW OF GAS-SEAL CAGE.

NAVAL NOTES.

WEEKLY NOTES ON NAVAL PROGRESS IN CONSTRUCTION AND ARMAMENT.

(BY OUR NAVAL CORRESPONDENT.)

AS with the training and education scheme of 1902, the new plan of distribution and mobilisation has been received by press and public without opposition. It is noteworthy, and indeed the most noteworthy feature of public opinion to-day that two such schemes, altering as they do the nature and recognised form of naval organisation should have been accepted with but little more comment than is given to the launching of a new battleship. New schemes of Army reform are discussed and opposed or championed with columns of praise or blame, yet naval reforms of such importance, fraught as they are with enormous possibilities for the future welfare or otherwise of the fleet, are but one-day wonders. They take up perhaps two columns in a back page of the paper on the day of their publication, and a leader may be devoted to them, and there the matter is allowed to rest. No one writes letters of a column and a half about them ; we are content to take the management of the Admiralty on trust, and while with both these schemes I am quite convinced, none can feel anything but satisfaction, there is the possibility that either or both of them might have been bad. Are we to believe that under such circumstances more notice would have been taken of them ? There is nothing to warrant such an assumption. This laissez-faire spirit on the part of the public is to be deplored. It is not the fault of the press. Readers of newspapers seldom look at naval articles. They understand that the Navy is our first line of defence, that everything is all right with the Navy and that they have not to trouble their heads about it. For every hundred men who discuss the Army and the War Office with sometimes a little more than superficial knowledge there is hardly one who knows or cares anything about the Admiralty. With the Board of Admiralty under Lord Selborne this policy of letting things slide has done no harm, but there is always the contingency of a weak board taking up the government of our fleet, and then the public's ignorance of what goes on at Whitehall may land us in Queer Street.

Such comment as there has been on the new scheme has been favourable. There is the continual harping on the subject of its being the sole work of one man, to which I referred last week, and everyone seems determined to find Sir John Fisher's hand in this. That we owe a great deal to the initiative and strenuousness of the present First Sea Lord none can deny. But he is not the Board of Admiralty, and without the support and countenance of his colleagues no ideas of his could ever be matured into effective measures.

Sir Edmund Fremantle in conversation with a journalist is reported to have said that he doubted the real value of a sudden change, such as had been made. But the changes to which Lord Selborne's Memorandum gives publicity have been in the course of evolution for some time past. The Navy is not accustomed to adopt changes which have not in some measure stood the practical test of time, and among the changes now given the authority of law, there is not one the utility of which has not already been proven. The advances which the Board of Admiralty under Lord Selborne have made have been steady and continuous, and the reforms instituted cannot correctly be described as "steps taken in a hurry."

The constitution of the new Channel (ex-Home) Fleet will be as follows

First (Heavy) Division. *Empress of India, Revenge, Royal Oak*, and *Royal Sovereign*.

Second (Light) Division. *Exmouth, Russell, Albemarle* and *Duncan*.

Third (Light) Division. *Montagu, Cornwallis, Triumph*, and *Swiftsure*.

The Heavy Division is principally for use in the channel, the Light Divisions being required for the comparatively shallow waters of the North Sea.

The Atlantic Fleet will, it is stated, be composed of the vessels of the *King Edward VII.* class, the name ship flying the flag of the Commander-in-Chief. Four of the vessels of the *Majestic* class will take the place of the vessels of the *Royal Sovereign* in the new Channel Fleet when the *King Edward, Commonwealth, Hindustan* and *Dominion* are ready for service.

Some little sensation appears to have been caused by the closing of Esquimalt and Halifax dockyards. And yet it should have been sufficiently obvious that after the withdrawal of our squadrons from North American and Pacific waters, it was only a question of a very short time before the dockyards there would cease to be of any use. Canadians have always held that they required no protection from a fleet, and now that the Admiralty are apparently of their opinion, they are talking about attempts at coercion and intimations "to the people of the Dominion that no pay no fleet," is the order of the day. "If such is the case," says one bellicose newspaper correspondent in Toronto, "the Imperial sentiment of Canada will soon make itself felt." How, he omits to tell us. The Imperial sentiment of Australia is apparently different to the Canadian variety, and Mr. Reed, the Australian Federal Premier, evidently voiced that sentiment when he said last week: "We are bound to look our responsibilities to the Empire in the face. We must not forget that the only thing between us and invasion is the British fleet. If we have nothing to give, we are face to face with a spectacle which does not command admiration." The second sentence I have quoted deserves widespread publicity. It is true of this country, as it is true of each of our colonies and dependencies, and the better we realise its truth, the better shall we be prepared to avoid invasion.

The explosion of coal gas in the bunkers of the *Majestic* of the Channel fleet on the 14th inst. has not happily terminated fatally, the two injured men being in Haslar hospital in a hopeful condition. A third man, an engine-room artificer, was also burnt, but is progressing favourably.

UNITED STATES.

There was a serious accident in the engine room of the battleship *Massachusetts* at the League Island Navy Yard on the 15th. Six men were killed, five fatally, and two others injured, but beyond the fact that they were in the engine-room effecting repairs, there is no news as to the cause of the disaster.

Messrs. Cramp and Sons, the builders of the new armoured cruiser *Pennsylvania*, are reported to be very proud of the performance of that vessel on her trials, when she attained an average speed of 22·43 knots on a four hours' trial, her coal consumption working out at 2·2 lb. per i.h.p. per hour. This is stated to be "the highest speed with the smallest relative expenditure of fuel of any armoured vessel so far built for the United States Navy." Yet compared with the vessels of our *Good Hope* class, this coal consumption is extravagant. On their eight hours' trials, the vessels of that class gave the following results:—

	I.H.P.	Speed, knots.	Consumption, lbs.
Good Hope ..	31,071	[illegible]	[illegible]
Drake ..	[illegible]	[illegible]	[illegible]
King Alfred ..	[illegible]	[illegible]	[illegible]
Leviathan ..	31,203	[illegible]	[illegible]

The horse-power of the *Pennsylvania* was over 28,000 and at one period of the trial was doing [illegible] knots. The *Colorado* which preceded her from Cramp's yard at the end of October made [illegible] knots at one period of her trial, but her average was 22·26 knots.

Admiral Converse, chief of the Bureau of Navigation, in his annual report, strongly supports the views of the late Admiral Taylor who preceded him in that Bureau. He considers that the American admirals are much too old. Of the Japanese flag officers, four vice-admirals and three rear-admirals average less than fifty, the youngest being forty-six and a half, and the oldest fifty-four. Under the most favourable conditions with the existing American law an officer does not reach flag rank till he is fifty-seven, while the average age is fifty-nine and three-quarters. To fight a war of more than a few months' duration of time, in a climate at all rigorous, and against an enemy approaching in strength that of the United States would, in his opinion unquestionably demand physical endurance of mind, body, and nerves, which are rarely possessed by men approximately sixty years of age, and in this view he is in practical agreement with all great military thinkers. It was Napoleon who said that at sixty "one is good for nothing" in war, and our own naval history illustrates the weakness of aged admirals.

Admiral Converse also supports the views of his predecessor on the subject of a general staff for the Navy, and as to the necessity for a large number of additional cruisers.

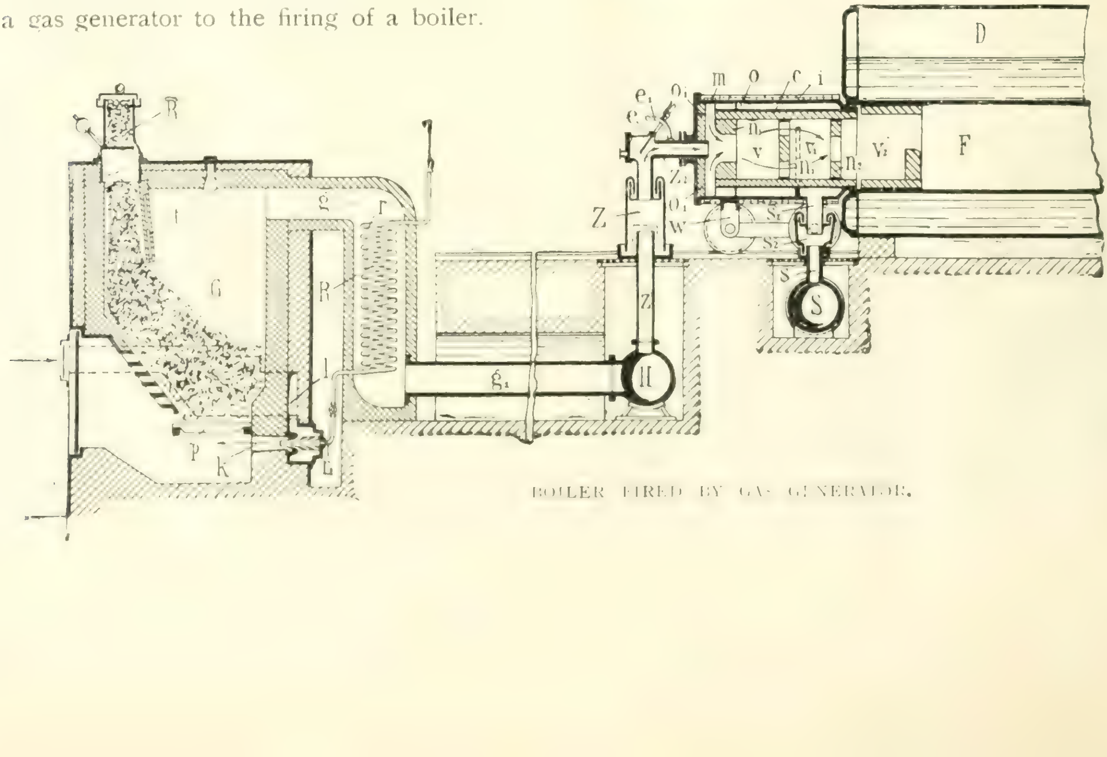
SWEDEN.

A correspondent sends me the following particulars about the Swedish Navy to supplement my note of a week or two back. There are three armoured gunboats and a submarines building, in addition to the vessels previously enumerated. These four vessels are expected to be completed by the end of the present year, as well as the t.b.d. of the *Mode* class. When they are finished the composition of the Swedish Navy will be: Twelve armoured coast defence ships, four monitors, seven armoured gunboats, five t.b.d.'s, 31 t.b.'s, eighteen of the first class, ten gunboats, two t.b.d.'s, and various out of date vessels in use as training ships, or other auxiliaries.

"SMOKE PREVENTION AND FUEL ECONOMY."

THE author's object in compiling this book, which is based upon the German work of E. Schmatolla, has been to bring before fuel-users the principles of fuel combustion and the means by which the practice of fuel combustion has been carried out—too often with little or no consideration of the physical and chemical conditions involved. They are strongly of opinion that coal of bituminous quality is capable of perfect combustion, and that black smoke is merely so much evidence of improperly designed appliances. This defect may be due, either to insufficient knowledge of the scientific principles of combustion on the part of the designer, or to parsimony on the part of the owner of the plant. A knowledge of this work put into practical effect should remedy the former evil, while the latter problem can only be overcome by greater insistence on the part of the sanitary authorities. The first section of the work deals with the chemistry of the combustion process; this is followed by a discussion on furnace construction and mechanical stoking, which is succeeded by an informing chapter on improved methods of burning fuel, from which we take the interesting diagram reproduced below, showing an application of a gas generator to the firing of a boiler.

The generator and the boiler here illustrated are one of a series, arranged in parallel on a common gas flue H. The boilers are of Lancashire or Cornish type. In front of each tube is a gas-combustion chamber V, V_1, V_2. Air is supplied through a main S through branch pipes S_1, S_2 to the individual combustion chambers. At R is a coil to superheat the steam supplied to the generator through the blower L, which induces an airflow under the grate. This air is heated in the wall channels l. Water gas is thus produced to some extent. It leaves the generator at a temperature of 600 deg. C. (= 1,112 deg. F.), and some of this heat is saved in the steam coil R. The gas passes through a pipe g_1 to the water-sealed bell Z, and thence to the chamber V, through a regulator e. Air is admitted at o, o_1, and thorough mixture is secured by means of the baffles n, n_1, n_2. This air is heated in the space between the combustion chambers and the outer casing. The combustion chamber is mounted on a carriage, and the bell Z being raised, severs the one joint between the gas-producer and the furnace. Another bell at S_2 serves to disjoint the secondary air-main.



BOILER FIRED BY GAS GENERATOR.

"Smoke Prevention and Fuel Economy." By W. H. Booth, M.Amer.Soc.C.E., and John B. C. Kershaw, F.I.C. Constable and Co. 6s. net.

NOTES ON PORTLAND CEMENT.

By Herbert E. Bellamy.

THERE is hardly any material used by the engineer, architect, or builder, which is of so much importance and interest as Portland cement, and the engineer, architect, or builder, is confronted by no problem more difficult than to say whether a particular kind of cement, when placed in any work, will behave in a predetermined way. Especially is this true with an artificial cement.

The object of testing cement is to determine two factors. Firstly, whether the product of a cement will attain the desired strength quickly enough to enable it to bear safely all stresses designed for it; secondly, whether it will afterwards fall below that desired strength.

Preference should be given to a testing machine which applies a pressure at the rate of 400 lb. in one minute.

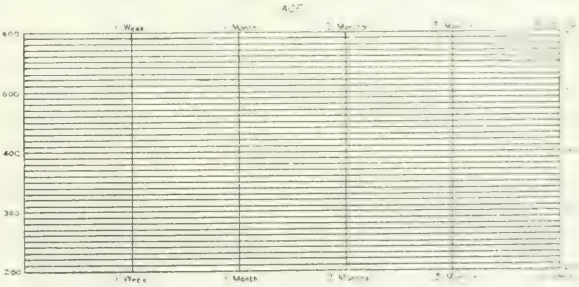
Difficulties are experienced in working the machine at so slow a speed, the impulse being jerky when applied slowly by the hand. The writer has obtained a difference of 40 per cent. between two briquettes mixed both from the same cask of cement when the times were thirty and sixty seconds for the tests respectively. The tests may be made under the following heads: colour, specific gravity, grinding, setting properties, strength, soundness, coolness, miscellaneous tests.

The accompanying diagrams (figs. 1 and 2) illustrate how a complete record of tests can be kept for official reference for any period. As they explain themselves there is no necessity to enter into an elaborate description of them.

NEW TESTS OF FINENESS.

It is a well-established fact that, other things being equal, the finer the cement the greater will its sand-carrying capacity be, and when a finely-ground cement is mixed with sand it gives a much higher average strength than that mixed with a coarse-ground cement.

To ascertain the cementitious value of the material a new form of testingapparatus—the Goscham Flourometer has been devised. It consists of a conical glass in which the cement is placed, a brass tube having a serrated end passing through the cement and resting on the bottom of the glass, a sheet metal tube, to the lower end of which the test glass is secured, a cylindrical settling chamber receiving a branch pipe projecting from the upper portion of the brass metal tube. The joints are airtight, and the settling chamber covered with a closely fitting lid. A weighed sample of the material is placed in the glass vessel, which is then clamped to the end of the metal tube, a stopcock on the air tube is opened, and as air issues from the serration of the brass tubes it carries away the impalpable portion of the cement, which passes into the settling cylinder. When the glass is removed and the residue weighed it is easy to determine the proportion of active material taken by the air, the residuum being anything from 50 to 80 per cent. In a [illegible] sure test the proportion of fine material passing the meshes would be much greater, but when samples of the same cements were thus tested for comparison, the variation was not more than 1 per cent. The flourometer tests for fineness is not intended to supersede recognised tests for other properties of cement but there is no doubt that it will be found in every way reliable.



NEAT CEMENT.

Fig. 1. Test diagram showing tensile strength in lbs. per sq. in.

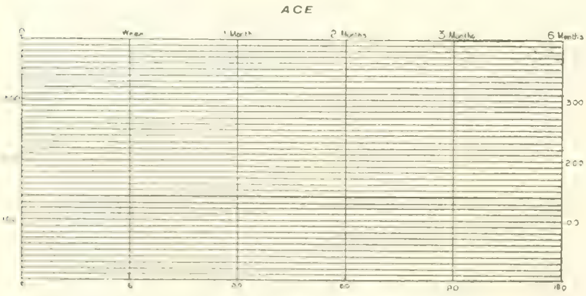
With regard to the test of setting qualities in which the Vicat and Gilmore needles are used, initial setting as ascertained by the Vicat needle should not take place in less than twenty-five minutes, nor final settling under two hours. The Gilmore needle, which is not so well known as the Vicat, consists of a steel needle one-twelfth of an inch in diameter, loaded with a weight of ¼ lb., and of a steel needle one twenty-fourth of an inch in diameter, and a weight of 1 lb. In use, the points of the needles rest upon the specimens, and are held between the fingers in a vertical position. The moment when the coarse needle fails to sink into the cement is called the time of initial setting; when the fine needle no longer penetrates, the moment of final setting.

TESTS OF STRENGTH.

These may be divided into compressive and tensile tests, the latter including transverse tests. Compression tests are, of course, rarely carried out, and, as a matter of fact, the ratio of compression to tensile strength is uniform, the resistance to compression being about twenty times the tensile strength.

To measure tensile strength a machine which applies the stress automatically at a uniform rate is preferable to one controlled entirely by hand. The test must be made immediately after taking the briquettes out of the water, and while they are still wet. The standard breaking weight usually specified is 400 lb. on the sectional area of one square inch. The tensile strength of Portland cement has been increased during the past decade, and there are some cements which will stand a tensile stress of 600 lb. per square inch. A cement having great tensile strength after a short interval of setting can only be obtained, however, by using a maximum amount of lime in the manufacture, and an excess of lime in the cement may cause it to expand in the work months after it is used. Over-limed cements are moreover totally unfit for use in sea water.

The test just mentioned applies to a seven days' cement; but a period of twenty-eight days is better. Neat tests are getting obsolete, and the test with sand three parts to one of cement, is preferable.



CEMENT MORTAR 3 TO 1.

FIG. 2. Diagram designed to show tensile strength in lbs. per sq. in.

The first table given indicates the tensile strength per square inch of Portland cement mortars as compared with the same class of cement neat as tested by the writer.

Age and time immersed.	Proportion of clean sand to cement.					
	Neat Cement.	1 to 1	2 to 1	3 to 1	4 to 1	5 to 1
1 week ..	440	140	66	49	17	6
1 month ..	676	328	189	98	62	42
3 months ..	680	530	447	284	149	98
6 months ..	—	645	483	305	250	197

The second table shows the superiority of fineness to strength.

Age of Briquette.	NEAT.		THREE OF SAND.		FIVE OF SAND.	
	10·2 per cent. residue on a sieve of 2·580 meshes per sq. inch.	Sifted so as to pass all through sieve of 32·257 meshes per sq. inch.	10·2 per cent. left on sieve of 2·580 meshes per sq. inch.	All passed through sieve of 32·257 meshes per sq. inch.	10·2 per cent. left on sieve of 2·580 meshes per sq. inch.	All passed through sieve of 32·257 meshes per sq. inch.
Weeks.	lb. per sq. inch.	lb. per sq. inch.	lb. per sq. inch.	lb. per sq. inch.	lb. per sq. inch.	lb. per sq. inch.
1	353	346	75	252	31	136
4	533	380	171	330	97	208
8	585	469	206	358	118	223
25	710	495	282	397	166	272

Tests for soundness, or constancy of volume in setting, should be a prime test, and attention should be directed to the importance of tests for coolness. Reference may be made to miscellaneous tests for cement, to ascertain if it is over or under-limed, and the chemical test is also important, as more than 2 per cent. of magnesia, or 1½ per cent. of sulphuric acid is held to be injurious to Portland cement. The writer regards microscopic tests as of little value where the adulterated matter has been finely ground. With reference to the use of slag iron for adulteration, this has been refused both for cement making and as an aggregate for concrete, because of the lime it contains but it is to be noted that properly treated slag is sometimes used as the basis of a good Portland cement.

From a Paper read before the Civil and Mechanical Engineers' Society.

THE UNDERTYPE ENGINE.

By J. C. R. Adams.

Previous articles by the same author on the subject of Portable Engines will be found in the July, August, September, and October numbers of Page's Magazine, and in the subsequent numbers of Page's Weekly.

OCCUPYING a position intermediate between the portable, or semi-portable, and the stationary steam-engine proper, we have the undertype engine, perhaps the most adaptable and convenient prime mover ever devised for permanent installations of moderate power.

The credit of having actually originated this variety is commonly ascribed to Messrs. Manning and Wardle, the well-known locomotive engineers of Leeds, who, about the year 1860 combined a small single cylinder side-crank horizontal engine with a locomotive boiler, upon the same bedplate. The type proving successful, several examples were made from time to time, but for some reason or other the manufacture was discontinued, and the undertype engine fell into disuse for a time.

In 1872 Messrs. Robey and Co., Ltd., of Lincoln, introduced the Robey engine, in the form of a double-cylinder horizontal engine under a loco-type boiler, the whole bearing a marked resemblance to a locomotive engine divested of its wheels. The original intention of this engine was its adaptation to winding and sinking purposes, in place of the overtype, or semi-portable, mining engine, in the manufacture of which this firm was then largely engaged. It will readily be seen that in the new pattern it was possible to keep the winding drums and gearing upon the ground level, instead of carrying them upon brick or stone piers, with an elevated platform for the driver as necessary in the larger sizes of the overtype winding engine hitherto employed. With the undertype engine, it became possible to place the levers operating the brakes, clutches, reversing gear, and regulator in convenient proximity to the fire-door, so that one man only was necessary for both driving and firing.

The Robey engine proved an immediate success, and many thousands of examples for general driving and industrial purposes have since been made by Messrs. Robey.

The advantages claimed—and with good reason—for the undertype engine, may be summarised as follows: Great saving of time and expense of fixing. Within a few hours of delivery, even a 200-h.p. engine of this class may be run into position, and the boiler filled up, little or no foundation beyond a well ballasted and level floor being required. The weight of the boiler and its contained water are amply sufficient to secure the engine against movement, without being bolted down to the foundation, while the boiler itself is absolutely free from any strains due to the working of the engine.

The space occupied in proportion to the power developed, is considerably less than for any form of stationary engine with separate boiler. There are no exposed steam pipes, hence dry steam is secured—an important advantage. The use of a brick chimney is dispensed with, as the iron funnel supplied with the engine can be lengthened to suit any situation.

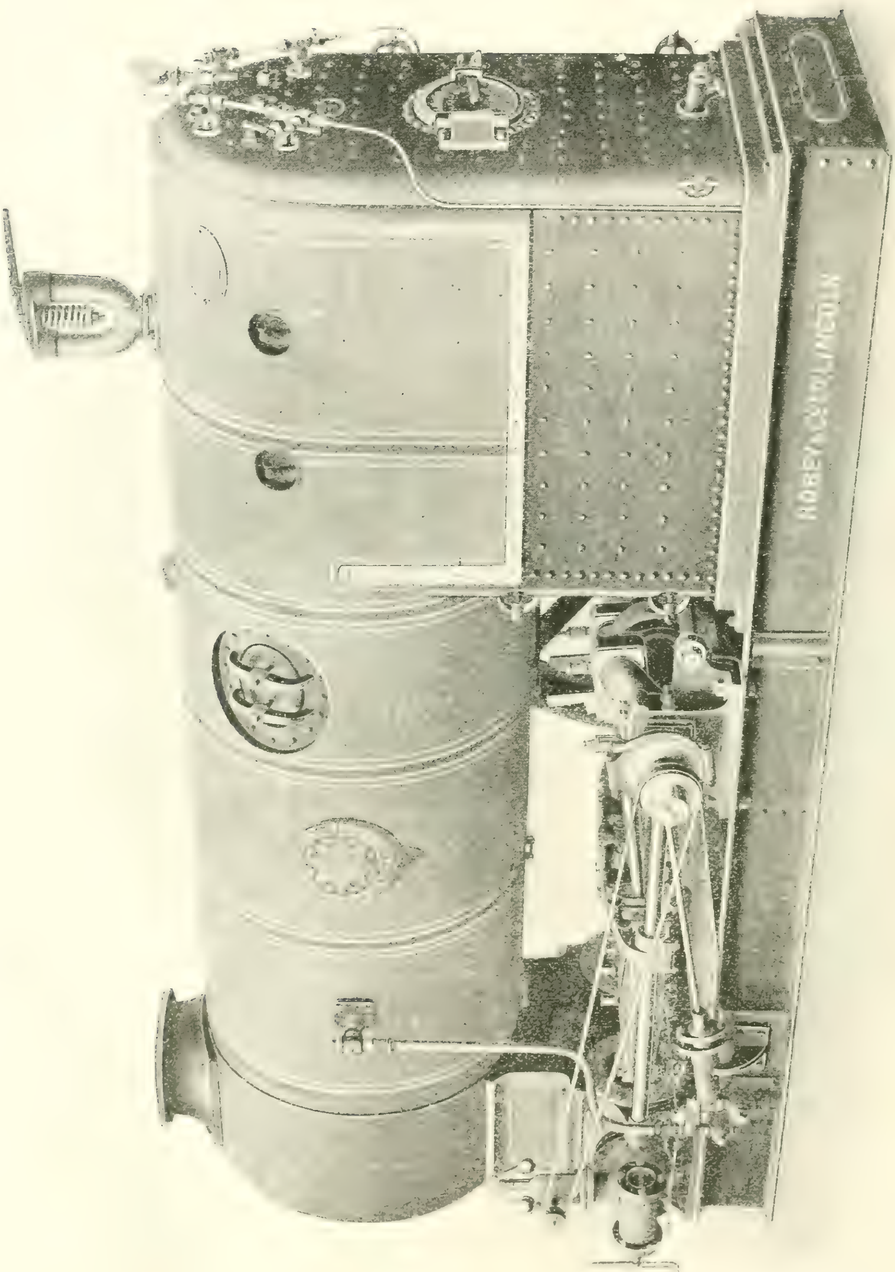


FIG. 1. DOUBLE CYLINDER ROBEY ENGINE.

Messrs. Robey and Co., Ltd., manufacture these engines in the following sizes, :—

ROBEY SINGLE UNDERTYPE ENGINES (FIG. 2).

Horse Power.		Cylinder.			Total Weight.
Noml.	Effective.	Dia.	Stroke.	Revs.	Cwts.
4	8–12	7	10	150	52
5	10–15	7½	10	150	63
6	12–18	8½	12	135	70
8	16–24	10	12	135	96
10	20–30	11	14	125	112
12	24–36	12	16	112	123
15	30–45	13	18	100	160

DOUBLE CYLINDER (FIG. I).

6	12–18	6	10	150	74
8	16–24	7	12	135	100
10	20–30	7¾	12	135	113
12	24–36	8½	12	135	132
14	28–42	9	14	125	137
16	32–48	10	14	125	170
20	40–60	11	16	112	225
25	50–75	12	18	100	270
30	60–90	13	18	100	310
40	80–120	15	22	82	450
50	100–150	16	24	75	[illegible]

Fig. 1 illustrates a variation applicable to all classes of Messrs. Robey's undertype engines, viz., the substitution of wrought-iron or steel girders for cast-iron in the bedplate. The main bearings of these engines are connected by tie-rods to the cylinders as in the portable engines with which, indeed, many of the working parts are interchangeable.

Automatic expansion gear, on the lines illustrated in a previous article ("Compound Portable Engines," (figs. 13–14), can be applied in place of the ordinary throttling governor, with excellent results as regards fuel consumption and regularity in running.

While the single cylinder undertype is well adapted for small installations for ordinary industrial purposes, and the double cylinder engine is pre-eminently fitted for winding and sinking, the use of non-compound engines of this class for driving purposes of any magnitude

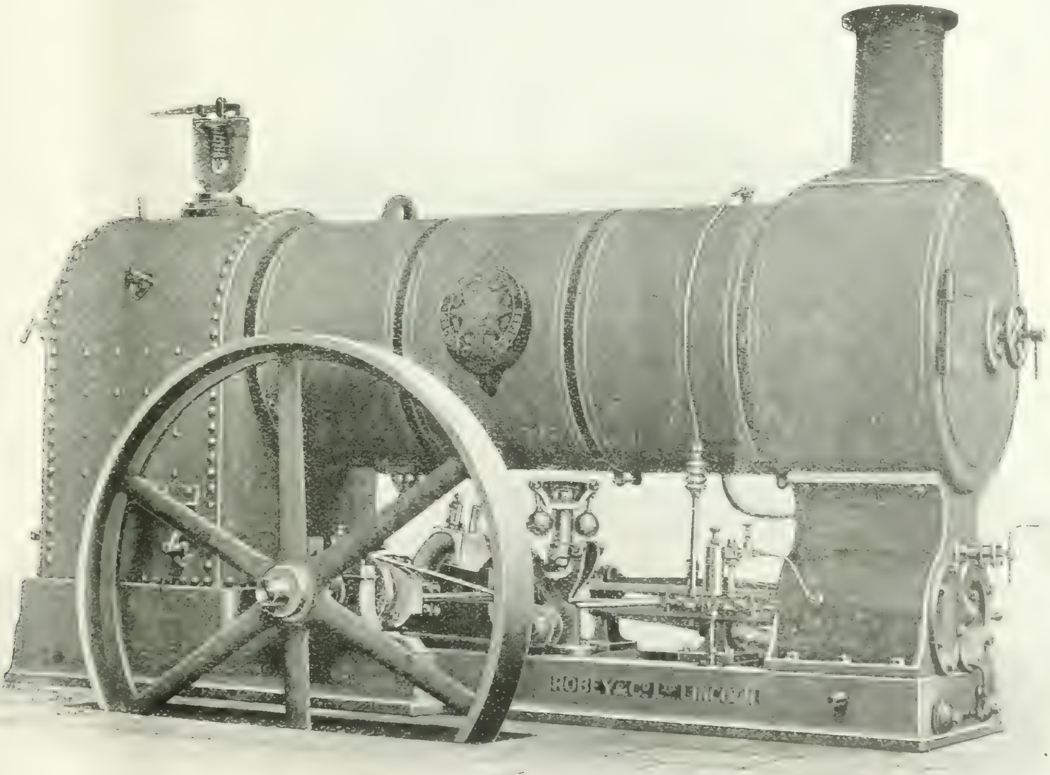


FIG. 2. SINGLE CYLINDER ROBEY ENGINE.

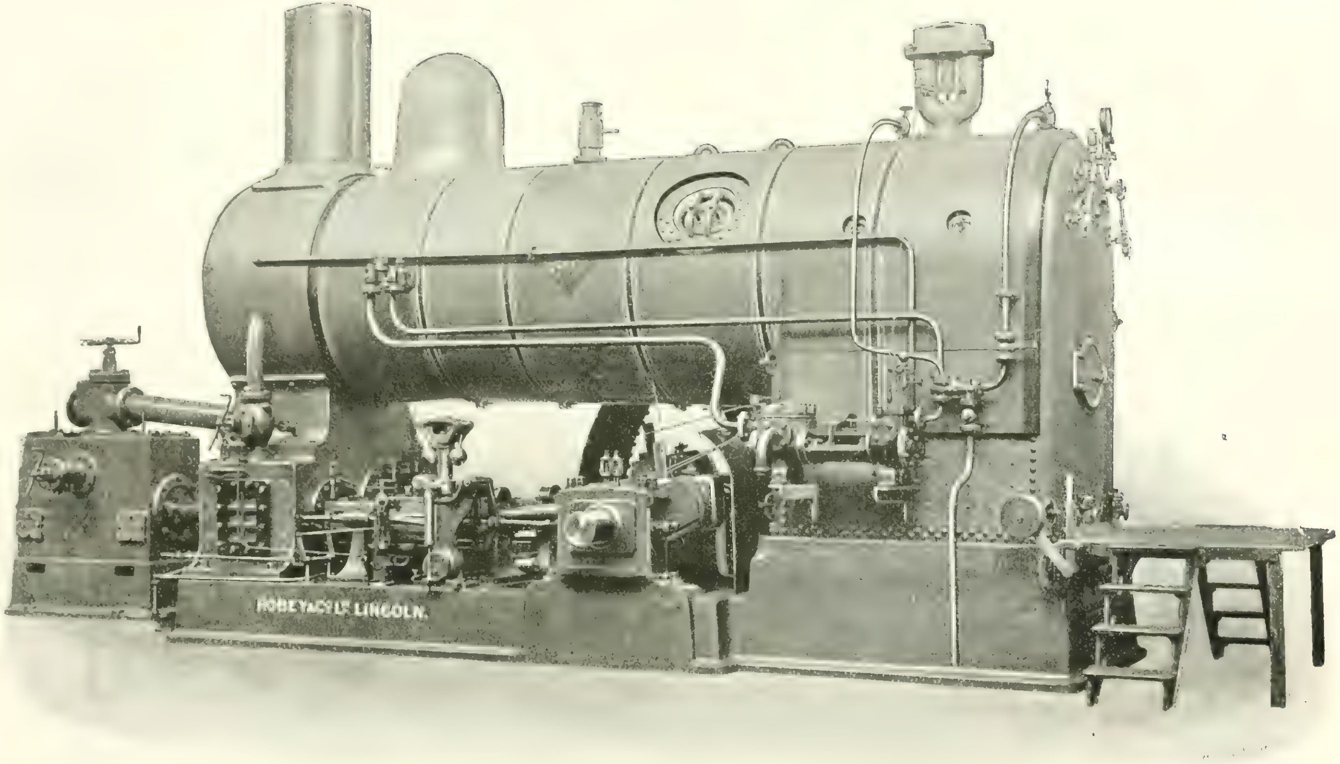


FIG. 4. COMPOUND ROBEY ENGINE.

is almost out of date. In the article just alluded to, I endeavoured to show that with coal assumed at 12s. per ton, the annual saving by compounding for an engine working ordinary hours, amounted to just £1 for every effective horse-power developed. It is not surprising, therefore, that the compound engine has practically superseded the simple type for ordinary purposes.

In fig. 4 we reproduce one of Messrs. Robey's compound undertypes, fitted with condenser, forming a very compact and complete unit of steam power, and capable of competing as regards economy of fuel with any kind or class of engine in use.

(To be continued.)

MINING NOTES.

GOLD DREDGING IN VICTORIA.

The gold dredging industry of Victoria is making steady progress year by year, the reason given being that the facility with which ground intended to be operated on by dredges can be thoroughly and inexpensively tested beforehand, enabling a near approximation of its value being arrived at before large sums of money are expended in machinery, etc., which might eventually not be required. The total quantity of material treated during 1903 by dredge mining and hydraulic sluicing by gravitation was 7,963,927, as against 6,911,697 cubic yards for the previous year. The gold obtained showed an increase of 8,957 oz., being 42,066 oz. as against 33,109 oz.; and the average yield of gold per cubic yard of alluvia treated was 2·39 gr., as against 2·19 gr. for the previous year. In all, fifty-one dredge-mining plants, comprising fifteen bucket dredges, twenty-three pump hydraulic sluices, ten jet elevators, and three rotary hydraulic plants were in operation, as well as fourteen plants for hydraulic sluicing by gravitation, and at the end of the year fourteen other plants were in course of construction.

THE EFFICIENCY OF ROCK DRILLS.

In a recent issue of the Mining Magazine Mr. Lucius I. Wightman gives an instructive summary of the uses of compressed air in mines. Small in size, but vast in its possibilities, the rock drill, he says, stands first among the applications of compressed air to mining operations. The rock drill made possible the mine of to-day, and the superior economy and effectiveness of machine over hand methods are no longer questioned. The only question at issue is the type of drill to be used, and this all-important point is too often determined by conversational and convivial prowess of a salesman, rather than by the merits of the machine itself. Probably no machine tool is more severely abused than the rock drill and this very fact suggests sturdy strength and hardy durability as essentials. These in themselves call for the greatest simplicity of mechanism. The fewer the parts, the simpler their form, and the stronger their material the better. The drill which uses the least volume of air per minute is not necessarily the most economical. The only true measure of drill efficiency is the volume of air required per inch of hole drilled.

COMPRESSED AIR FOR HOISTING.

Compressed air for hoisting, says Mr. Wightman has long since passed the doubtful stage. For large surface hoists steam still holds the field against all, but in underground workings—at winzes, up-raises and short inclines—the hoister driven from the air line has successfully discharged its duties. In these locations, far from the surface, steam is forbidden by the loss in transmission; the fumes from a gasoline hoist prohibit its use; and electric power is probably not available. But if an air pipe is at hand nothing else is necessary. As mines develop and cost of fuel increases, compressed air for hoisting will receive more general adoption. The large air hoist, taking air from a high-grade compressor plant, driven directly or electrically from a water power, will certainly show an economy higher than that of a steam hoist with high-priced fuel and water, and will compare favourably with the direct electric hoist. But it will have to be properly designed, and reheating must secure the economies of expansive working.

THE FUTURE OF COMPRESSED AIR.

Mr. Wightman is emphatic in laying down that the future of compressed air in mine operation lies along the lines of general application already approved. Future advances will result in greater economies—economies in production, distribution and application. In production, cheaper power and improved design in motive and compressing machinery will reduce the cost per unit volume of air compressed. In distribution, the alluring possibilities of the "return pipe" or "closed circuit" system will be developed to the utmost. In application, improved design will add to machine effectiveness and new types will be found. The use of reheaters—open, for surface working, and internal combustion, for underground work—will secure greater economy through expansive use of the air. Higher air pressures will secure more efficient compression, render more effective the working tool, and increase the commercial efficiency of the entire installation. Advancement in mine methods, operation, and management will be secured only by careful study of the lines of present compressed air practice, aided by a readiness to branch out along new lines as they are suggested by sound theory and approved by stern engineering judgment.

OUR WEEKLY BIOGRAPHY.

SIR CHRISTOPHER FURNESS, M.P., D.L.

SIR CHRISTOPHER FURNESS, whose name is equally well known as a ship-owner, shipbuilder, engine-builder, colliery-owner, and iron manufacturer, was born at West Hartlepool, on April 23rd, 1852. At the outset of his career he did not appear to have decided upon following any particular vocation, but upon the completion of his education, he became associated in business with his brother, Mr. Alderman Furness, J.P., importer of foreign produce, for whom he travelled as a commercial representative.

Before the outbreak of the Franco-German War in 1870, a line of steamers plied regularly between Hamburg and Hartlepool, but at the commencement of hostilities the Elbe was blockaded and traffic suspended. Christopher Furness, who was then eighteen years of age, was sent by his brother to Sweden in order to arrange some important business transactions on behalf of the firm. While the war was in progress he remained in Sweden and Denmark, and dispatched from there many cargoes of the various commodities handled by his brother's firm. On his return to England, in consideration of the successful manner in which he had accomplished this commission he was made a partner in the business. Seven years later, prompted by a desire to enter a field of greater industrial activity, he dissolved partnership with his brother and established himself as a shipowner.

Photo by Elliott and Fry.

SIR CHRISTOPHER FURNESS, M.P., D.L.

When the senior partner retired from the firm of Messrs. Edward Withy and Co., shipbuilders, Mr. Furness acquired his interest and shortly afterwards an amalgamation was effected with his own firm. This firm was the first among shipbuilders to adopt an extensive system of flanging, instead of riveted bars and plates, in almost every part of the vessel.

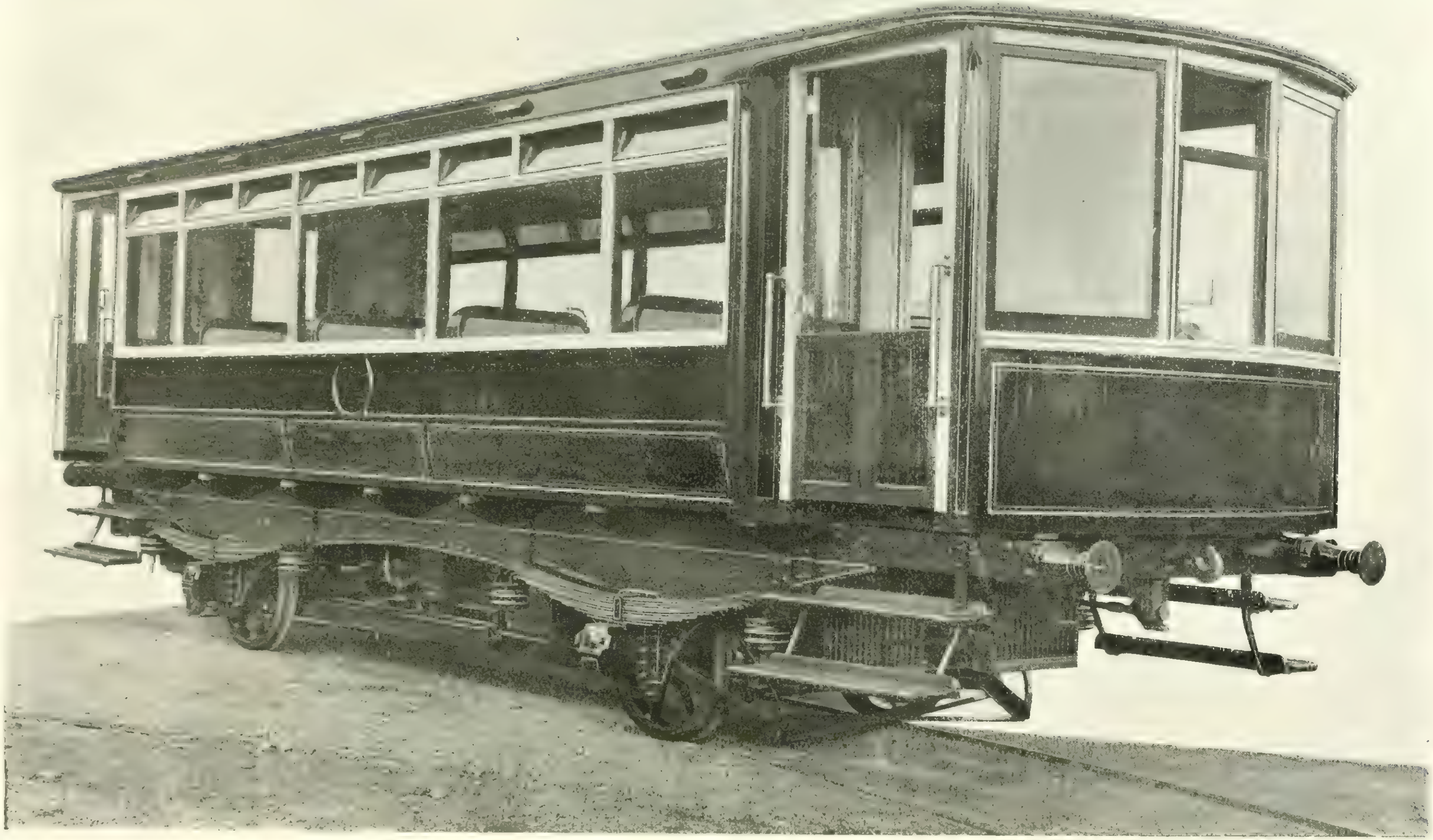
In 1882 he went to Canada, and as a result of his conference with Sir John Macdonald, the Prime Minister, it was decided that a line of steamers should ply from London to Halifax and St. John.

He was returned Member of Parliament for the borough of Hartlepool in 1891, and was re-elected in 1900.

Sir Christopher Furness is the Lord of the Manors of Cundall and Grantley, Deputy-Lieutenant of the County of Durham and the North Riding of Yorkshire. In May, 1895, Queen Victoria bestowed upon him the honour of knighthood in recognition of the valuable services he had rendered to shipping and commerce.

PROFESSOR GISBERT KAPP.

PROFESSOR GISBERT KAPP, who, as we announced in a previous issue, was recently appointed to the Chair of Electrical Engineering at the University of Birmingham, is an Austrian. He first came to England in 1875, and about seven years later he became engineer to Messrs. Crompton's works at Chelmsford. In 1885 his elucidation of the law of the magnetic circuit brought him into considerable prominence, and for a short period in the same year he was a partner in the firm of Messrs. Allen and Kapp, who made the first dynamo from Professor Kapp's design. He practised as a consulting engineer in London until 1894, when he left this country to take up a post as secretary to the Verband Deutscher Elektrotechniker, and subsequently he became a lecturer on Dynamo Construction at the Charlottenburg School.



NEW TYPE OF PETROL MOTOR-CAR FOR THE GREAT NORTHERN RAILWAY.

The engines are of the standard Daimler type, each capable of developing 36 h.p., running at full speed. A separate petrol tank is provided for each engine, and the combined capacity of these is equal to 400 car miles.

The complete car weighs something under 16 tons, including its full complement of passengers, and although the normal speed for which it is designed is 30 miles per hour, it has on several occasions attained a speed considerably over 50 miles.

The car is lighted by electricity obtained from storage batteries, which also supply current for the ignition and magnetic clutches. The design of the complete car is such that by jacking up the body, the underframe and machinery can be run out in the same manner that a truck can be taken from beneath a standard electric tramway car, but in addition to this, the frame containing the machinery can be dropped from its bearings on the axles without removing the truck from underneath the car body.

New Petrol Motor-Car for G.N.R. Branch Lines.

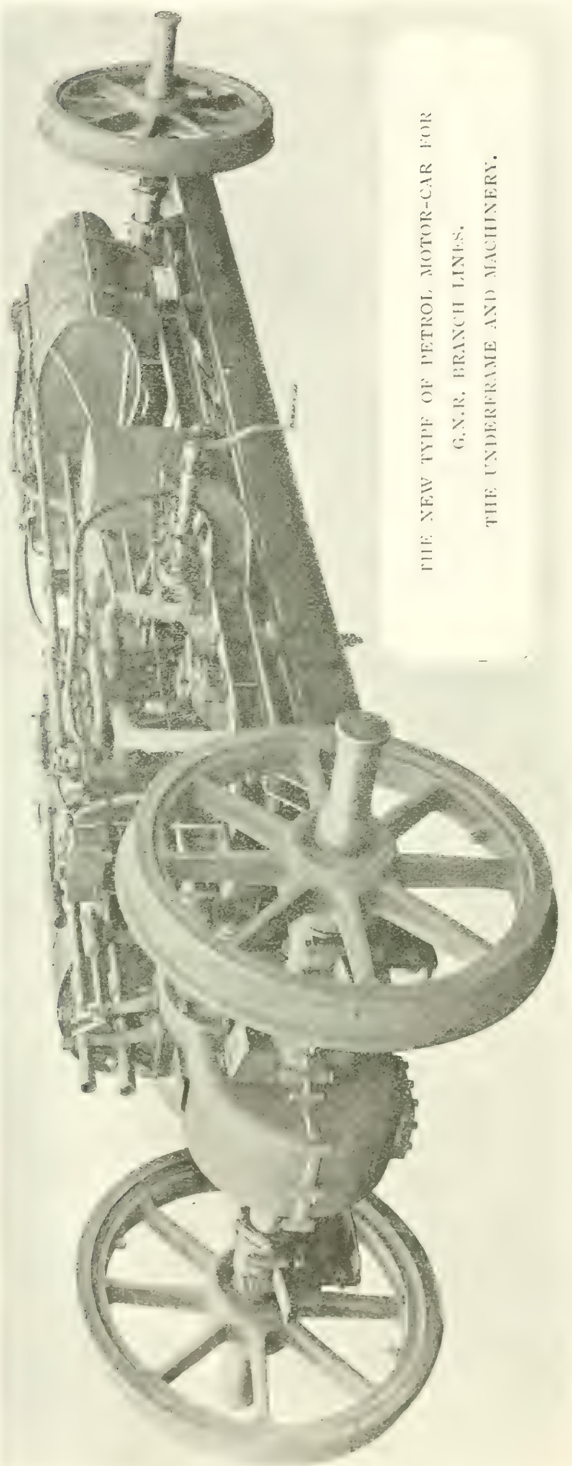
THE economical operation of short branch line traversing sparsely populated country, has been long one of the most important problems of railway management, and it is generally admitted that inefficiency of working arises from the necessity of employing steam locomotives.

The ordinary steam-hauled train operates to the best advantage either over long distances or where traffic is fairly dense, but is unsatisfactory where traffic is light, for the reason that it is impossible to materially reduce the number of operators. Even under conditions which would permit the use of short trains, it has been incumbent to employ two men on the locomotive and at least one guard on the train. In addition to the use of a considerable amount of rolling-stock for unremunerative traffic, there are the stand-by losses which must be a very serious matter in the case of a railway system on which branch lines are numerous. It is evident, that under such conditions, an automobile type of car presents obvious advantages, and recognising the possibilities of such a type of vehicle, railway managers have evinced the keenest interest in the development of a self-contained coach for railways.

For some time past a good deal of experimental work has been carried on by various railways throughout the country to determine which type of automobile seemed best suited to their peculiar conditions.

While some railways have been carrying out experiments with steam automobiles, others have adopted petrol cars, and in one case a combined petrol and electric has been employed. But though an automobile system immediately reduces the operating staff, gives a greater degree of flexibility and obviates the necessity of much rolling stock lying idle, there are at the same time certain conditions which the automobile must meet, even presuming that a reliable type of motor is obtained, in order to ensure its successful application. It is essential that such a vehicle should deal with traffic under periods of abnormal demand, and yet be capable of economical operation if traffic is light. Moreover, under some conditions it would not be sufficient that an automobile should be powerful enough to draw its own load, because there are cases where it would be an advantage for such a vehicle to be able to draw an extra coach, a goods van, or horse box.

During the past few months the Great Northern Railway have been carrying out most interesting experiments in this direction. Probably no line in the country has a larger number of branch lines traversing thinly populated districts than this company, and as on other railways, many of these branch lines were unremunerative, Yet, as a feeder to the main line system, the short branch lines were exceedingly necessary. and under these conditions an automobile, if a satisfactory one could be devised—appeared to offer considerable advantages. With this clearly before them, the Great Northern Railway Company have been operating a petrol car, which, while being valuable in demonstrating the possibilities of this class of vehicle under special conditions, is also interesting on account of new features which in many respects constitute a distinct advance in this type of vehicle. The car has been specially designed by Messrs. Dick, Kerr, and Co., and in evolving it they have been able to utilise their special experience in electric tramcar construction. The system of applying two electric motors to a tramcar has been copied in the automobile, two petrol engines being employed, which are connected to a shaft in a manner which will be described.



THE NEW TYPE OF PETROL MOTOR-CAR FOR G.N.R. BRANCH LINES.

THE UNDERFRAME AND MACHINERY.

The car, which is now being operated on the Great Northern Railway, will be, in all probability, utilised on one of the branch lines running from Hatfield. The seating capacity is 32 passengers, but it is obvious that this can be considerably increased, and the firm is already engaged on a larger type of car, which will not only carry considerably more passengers, but will also provide a certain amount of space for luggage.

The whole of the machinery is assembled upon a frame, which is directly supported from the axles. It is thus entirely insulated from the body of the coach, with the consequence that even while standing at a station the noise and vibration from the engines is quite imperceptible to the passengers.

As already indicated, following the practice now generally employed in electrically driven cars, the motive power consists of two engines. This not only minimises the risk of breakdown, but gives a better distribution of weight. The engines are not, however, connected independently to the axles, although both axles are driven, but under normal circumstances drive on to a common longitudinal shaft, which is connected to the axles by bevelled gearing. To overcome the difficulty of one axle over-running the other, owing to any possible inequality in the diameter of the wheels, a special form of differential gear is introduced, and combined with this special gear is the reversing mechanism. The engines are connected through independent clutches to a common change speed box from which the power is transmitted, by means of the longitudinal driving shaft referred to above, into gear boxes suspended on each axle, and at this point the engine speed is reduced as required on the axles by means of single reduction gearing very similar to that used in the electric tramway motors.

The design of the car and its experimental operation have been under the personal supervision of Mr. Oliver Bury, the General Manager of the Great Northern Railway Company

QUESTIONS OF THE DAY.

III.—The National Encouragement of the British Inventor: How Can it be Secured?

(*Continued from page 850.*)

THE correspondence on this important question, which has appeared regularly in PAGE'S WEEKLY since October 28th, is based upon the following questions :—

1.—Do you consider that the new Act will offer a satisfactory solution to the difficulties of patentees, and in what direction do you advocate further legislation ?

2.—What is your opinion as to the effect of the yearly fees which, in the event of renewal, are at present payable between the fifth and fourteenth years ? Should the British Patent Department be run so as to produce a profit for the Exchequer by the penalising of the inventor ? Should the Patent fees be reduced to the proportion of those charged by the American Patent Department ?

3.—What do you consider should be the constitution of the proposed searching staff, and how far should the search extend ? Do you consider that the examining staff to carry out the provisions of the New Patent Act should be supervised by a council of practical and acknowledged experts, selected by the Government ?

4.—How many years do you consider patents should run ? Do you think seventeen years' effective duration without further taxation, as in America, an equitable arrangement ?

5.—Have you encountered any instances in which our existing patent regulations have strangled an invention?

6.—Do you consider that the term of a patent life should be proportionate to the importance of the invention, and to the time and money expended in its commercial perfection ?

7.—Is it your opinion that, when challenged, the inventor should be required, at a certain period of, say, any time after four years from the date of application, by affidavit, to prove that he, the inventor, has done his utmost to secure the commerical working of his invention ?

8.—Do you think it advisable that the Patent Department should offer prizes for the encouragement of the inventor ?

9.—Do you consider that the life of a patent should date from the time when it is commercially perfected, but limited to a period of seven years ?

10.—Should a foreigner who has patented an article in England, be allowed to import the article, manufactured abroad, into England, unless he can prove that he has attempted to secure the manufacture on fair terms in this country ?

11.—Should there be a council appointed by the Patent Office Department to determine rates of royalty and licenses, and take into consideration the time and money risk involved in protecting an invention in order to fix the term of years to be allowed the inventor in which to secure a fair recompense ?

12.—Should patent cases be tested before a special tribunal of technical and legally trained experts, instead of the Judges with little or no knowledge of practical science ?

The following are among the further letters received up to the time of going to press :—

115, Cannon Street, E.C.

To the Editor of PAGE'S WEEKLY.

DEAR SIR,—My replies to your queries are as follows :—

1. No ; the limited search among British patents only is very little use so long as the courts take into consideration anticipations from other sources.

2. (*a*) Renewal fees are not only useful for keeping up the Patent Office, but also in weeding out useless patents.

(*b*) Yes ; I think so.

(*c*) No.

3. (*a*) The search should extend to fifty years or other term, beyond which the courts should disregard anticipations.

(*b*) Yes ; examiners from 20 to 25 years of age cannot have had much experience.

4. (*a*) Fifteen or seventeen years, in my opinion.

(*b*) No.

5. Yes ; but there must be some such instances in any event.

6. No ; but greater facilities might be provided for prolongations in exceptional cases.

7. No ; compulsory license provisions are better.

8. No ; the Patent Department should not offer prizes.

9. No ; the present provisions are better.

10. No ; he should not be allowed to import, except as stated.

11. Yes ; or it might be left to the tribunal mentioned in Question 12.

12. Certainly.—Yours faithfully,

S. E. GUNYON, F.C.I.P.A.

19–19A, Imperial Buildings,
Ludgate Circus, E.C.

To the Editor of PAGE'S WEEKLY.

DEAR SIR,—Inventors are a class of people who should be encouraged instead of being followed by despicable treachery, and the agents of hostile businesses, making it almost impossible for them to gain a livelihood. I reply to your questions:—

1. I advocate further legislation in the direction of a British Imperial patent covering the Empire.

2. All yearly fees in the event of renewal, or those which are at present payable between the fifth and fourteenth years are an outrage on invention.

3. The finest searching staff procurable should be employed.

4. Patents should run for seventeen years.

5. Strangled an invention! They always do, to the injury of the nation in the long run.

6. No, not at all; the nearer to Rome the worse the catholic. An examiner does not realise what an invention may lead to.

7. Where invested interests and trusts are, they do all they can to prevent the output of competing inventions; and right should not be hampered.

8. No; don't inflict agony upon the poor inventor, and get others in the same unremunerative field.

9. When issued the life should be commenced, but years made up by special act to pay for fighting towards perfection without remuneration.

10. Protection for manufacturers is all that will save England from bankruptcy.

11. Compulsory licenses are good and bad; but Patent Board acting for inventor and would-be user might help. Both time lost and money risk don't pay inventors.

12. Yes; patent cases should be tried before a Patent Court consisting of technical and legally trained experts. The files of the United States Patent Office, the finest in the World, can be procured, and good search for the state of the art made by the examiners.

Yours faithfully,

B. C. POLE.

Re Patent Laws.

70, Gracechurch Street,
London, E.C.

To the Editor of PAGE'S WEEKLY.

Sir,—Mr. Thwaite apparently considers that the more patents existing in a country, the better the conditions of its industry. He favours the American system, whereby a patent once granted requires no renewal fees; and he considers an invention to be lost to the country if the patent protection ceases. He ignores the fact that most scientific discoveries are not patented at all, and the fact that most of the detail improvements that usually form the subject of patents would probably be developed, if valuable in themselves, irrespective of patent protection.

If a patent as such were a public benefit, there would be no occasion to limit its duration; but everywhere a patent is made a terminable monopoly, whereby the inventor's gain is temporary, and the subsequent public gain is unlimited.

The sole reason for granting a patent is to give the patentee a temporary monopoly, so that he shall have a limited personal and pecuniary interest in developing his invention for the ultimate benefit of industry in general.

Mr. Thwaite omits to mention that the United States is the only country of importance where renewal fees on patents are not required, nor does he mention that the German renewal fees are about three times as heavy as the British, while Germany enforces a rigid working of the patent; and, in short, that the German policy is to restrict patent protection as much as possible.

On Mr. Thwaite's theory, then, Germany ought to be in a far worse position than England, as her practice is the opposite extreme to the American. Our own law is a characteristic compromise between the two extremes, and, as now amended, appears on the whole to be the most equitable.

Mr. Thwaite shows that only one British patent in fourteen is maintained throughout its term. He does not mention that a very considerable proportion of these British patents that are allowed to lapse are held by Americans, Germans, and other foreigners; but the fact is that no nation takes any regard of nationality of patentees, invention being the one thing in view.

It is conceded, therefore, that no matter what the nationality of the patentees, the bulk of them find their patents not worth the moderate renewal fees In other words, the great bulk of patents prove absolutely worthless; and surely, if an inventor, after four years, cannot raise £5 for its renewal fee, and a fee rising £1 annually till the end of the fourteen years, then it must be to the public interest that the patent should lapse, the invention become public property (so that its worth, if any, without monopoly, can be tested), and the inventor himself left free to devote his attention to some more useful matter.

Regarding the development of industry in America, Mr. Thwaite appears to confuse cause and effect. He argues that industry is healthier in America than here, because there are more patents existing there.

Those who know American industrial conditions are not agreed that they are healthier, but with twice our population (of very mixed races), a rapid development of resources there is inevitable; and with the American appetite for novelty as novelty, and the national concentration on the struggle for wealth, the local conditions are favourable to the development of inventions, quite apart from patent laws.

But, just as in America there are innumerable laws that are never applied, so there one finds a tendency to evade or ignore patent rights; and, consequently, the enormous number of existing patents rarely affords effective monopoly, and does not much check f the diffusion of useful inventions, unless they are powerfully backed.

On the other hand, in Germany, such patents as are granted and kept in force under their restrictive methods, are far more effective protection to their inventors.

It is, of course, conceivable that a foreigner holding a British patent can artifically prohibit its manufacture here, and create a market for his foreign-made invention; but his advantage can only be temporary, and this country will benefit by his creating a demand which will be met locally on the expiry of his patent.

It is impossible to frame any law under which no hard cases will arise. Let us by all means compare the practice of other nations with our own, but let us always bear in mind also the difference in local conditions. Industry, nowadays, is cosmopolitan; any valuable invention quickly spreads throughout the world. The development of invention is, therefore, a general benefit, and the wisest policy is to have the minimum of restriction on the natural growth of industry.

Yours faithfully,

CHARLES ERITH.

CIVIL ENGINEERING NOTES.

Additional Waterworks for Bloemfontein.

The new waterworks at Mazel's Poort were officially opened by Lord Milner on November 19th, in the presence of a distinguished company, who were much gratified at the visible results of fourteen months' construction work, and the removal of all anxiety as to sufficient supply for the city in the future.

A weir has been constructed of concrete across the Modder River, 360 ft. in length, 22 ft. wide at base, and 5 ft. wide at summit, raising the water level 12 ft. The weir rests on a foundation of solid rock and forms a pool about three miles long, with a storage capacity of 207,000,000 gallons. There are three concrete settling tanks each holding 2,000,000 gallons, and five sand filter beds with a total area of 22,000 square feet.

The rising main from Mazel's Poort to Bloemfontein is 12 in. diameter, of cast iron, thirteen miles long. The water from the river passes through a tunnel 500 ft. long to the engine-house, the floor of which is 50 ft. above the river to avoid risk of flooding. The machinery was supplied by Messrs. Glenfield and Kennedy, Ltd., Kilmarnock. It consists of four Lancashire boilers, 20 ft. by 6 ft. 6 in. diameter, two sets of triple expansion engines each with a capacity of 650,000 gallons per 24 hours against a lift of 650 ft., and two well engines with Ashley pumps, each of 1,000,000 gallons capacity in 24 hours.

The works were designed by Mr. H. F. Peet, Assoc. M.Inst.C.E., city engineer to the Corporation of Bloemfontein. Another weir is in course of construction at Mockesdam, above Mazel's Poort, with a capacity of 460,000,000 gallons, which will also be available for Bloemfontein in the near future.

Gibraltar Harbour Works.

The construction of the Commercial and Coaling Mole at Gibraltar has been steadily proceeded with, and it is expected by the Navy Loan Works Department that the work will be completed and the mole fully equipped and brought into use early in 1905. Accommodation will then be provided in an enclosed harbour, with a depth ranging from 30 to 20 ft., for vessels, which will be able to lie in security alongside a wharf and coal or discharge cargo, or take in a supply of fresh water at any hour of the day or night with facility and dispatch.

Electric Railway up Mont Blanc.

The recently sanctioned railway up Mont Blanc will be the highest in the world. The franchise for this achievement has been granted by the French Government to Messrs. Deraud and Duportal. The railway will have its lower terminus at the town of Fayet, and will climb the southern slope of the mountain range to the summit three miles above. Owing to innumerable engineering difficulties in the scheme, the railway will follow a tortuous route. It will be electrically operated, the necessary motive power being supplied from the mountain torrents and waterfalls abounding in the district.

Rails for Fast Traffic.

The following summary and conclusions are from the International Railway Congress report on the question of rails for lines with fast trains :—

Experience seems to prove that neither metal sleepers nor longitudinal sleepers are suitable for busy lines with fast traffic. The weight of rails tends to increase with the speed. Heavy rails have certain advantages over light rails ; the track requires less maintenance and fewer renewals, the rails get worn less and break less. With excellent rolling stock and well-balanced locomotives, the necessity of using heavy rails is not so paramount.

Putting in the rails so that the web is vertical has more disadvantages than advantages. It would be desirable to have a wider head, and to have a flat rolling surface like the tyre, so as to prevent the hollowing out of the latter by the mutual action of the two bodies in contact. The minimum thickness of the head can be reduced to 3·5 centimetres ($1\frac{3}{8}$ in.). By widening the head, the surfaces on which the fishplates can bear are increased ; this reduces the excessive wear of the rail and fishplate surfaces in contact with each other, and consequently the deformation of the joint ; for this same reason, the steel used for fishplates should be as hard as that used for the rails, contrary to the usual but erroneous practice. It may be possible to do away with metal bedplates (which appear to make the running less smooth by using oak or beech sleepers.

The manufacture of Thomas steel rails has made considerable progress during the last few years; these rails resist wear as well and do not break more frequently than rails manufactured by other processes. The rails must be rolled at a low temperature: 850 degrees C. (1,562 degrees F). Rails rolled at a too high temperature, with a coarse crystallisation, can be improved by reheating to a suitable temperature. In order to have steel of good quality, it is desirable in the case of Vignoles rails, to roll sections with flanges thick at the edges at least $\frac{33}{46}$in.

Specifications laying down that part of the ingot, bloom or rolled bar that is to be cut off should not specify the exact amount to be cut off: the better the manufacture, the less the liquidation and piping is there and the less need to be cut off.

The chemical composition, in percentages, of rails should be about: silicon, 0·1; manganese, 1 to 1·2; carbon, 0·5; sulphur and phosphorus, less than 0·1. Is it true that the resistance to wear is increased by increasing the proportion of silicon to 0·5 per cent.?

Steel having an ultimate tensile strength of at least 41·27, and even of 44·45 tons per square inch, and an elongation of 10 per cent., is to be preferred for rails; for special track appliances, it is advisable to use even harder steel. Steel for the tyres of locomotives and express rolling stock must be hard and tough; it should have an ultimate tensile strength of at least 44·45 tons per square inch, and an elongation of 15 to 20 per cent.

Nickel steel is not used for rails and it is unnecessary to try it for European traffic; heavy rails of hard steel rolled at a sufficiently low temperature seem to be more economical even at places where there is an abnormal amount of wear and tear. Nickel steel might be tried for tyres. Several systems of supported and suspended rail-joints are being tried; but sufficient time has not yet elapsed to make it possible to draw any conclusions. Reducing the width of the expansion gap in the case of heavy long rails should be tried.

Broken joints (in the case of 59 ft. or longer rails) seem to be preferable to joints opposite to one another. Welded joints are not to be recommended. It is desirable to have long rails; 59 ft. is now a usual length; perhaps it would be possible to go to 78 ft. 9 in., if there were no difficulties of transport. Would it not be possible to make trials of tight joints without expansion gaps over long distances, which would fulfil the same functions as welded joints?

Creeping is counteracted without difficulty.

OBITUARY.

It was as recently as October 28th, that a biographical notice of Sir Lowthian Bell appeared in PAGE'S WEEKLY, and the photograph which appears on page 901 of this issue was specially taken for this journal only a few weeks ago. The distinguished metallurgist, one of the founders of the Iron and Steel Institute, was at the time of his death, President of the Institution of Mining Engineers.

Mr. John Allen McDonald, chief engineer of the Midland Railway Company, died on Sunday last at his residence at Borrowash, near Derby. He succeeded Mr. A. A. Langley, as chief engineer in 1890. As chief engineer his principal task was the construction of Heysham Harbour, for which he was joint engineer with Mr. G. N. Abernethy,

The news of the sudden death from heart failure of Lieut.-Colonel Sebastian Smith, V.D., F.S.I., M.I.M.E., was received with great regret in mining circles. He was a Fellow of the Society of Arts, and received the gold medal for the improved method of breaking down coal by compressed lime cartridges; he was also the inventor of the patent safety pit head props.

Mr. Joseph Nasmith, whose death is announced was the author of several standard books: "Modern Cotton Spinning Machinery," "Modern Mill Construction," and "The Students' Cotton-Spinning." He was for many years editor of the Textile Recorder, and had been President of the Manchester Association of Engineers.

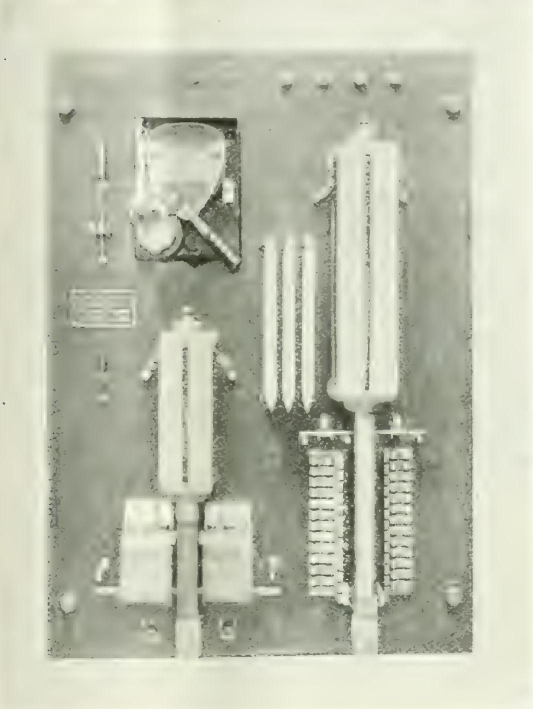
The death of Mr. T. V. Sigvold Muller, the well-known railway engineer, is reported. He was in the course of a long professional career associated with the Great Eastern, and through the firm of Peto, Brassey and Betts with the Chatham, the Metropolitan, and other railways. He also acted as engineer to railways in Turkey and in Brazil and Ecuador.

Mr. Charles Belk was the senior partner in the firm of Roberts and Belk, one of the oldest and best-known Sheffield houses. He occupied the position of Master Cutler in 1885, and always took a keen interest in the commercial development of Sheffield.

By the death of Mr. William Ford Smith, the founder and chairman of Messrs. Smith and Coventry, Ltd., Salford, Lancashire has lost an eminent engineer. Mr. Smith contributed valuable papers at different times to the Proceedings of the Iron and Steel Institute, of which he was a member, and he will be remembered for his labours in connection with machine tools, for which he took out many patents.

THE PASSENGER LIFT INSTALLATION AT SHEPHERD'S BUSH STATION, C.L.R.

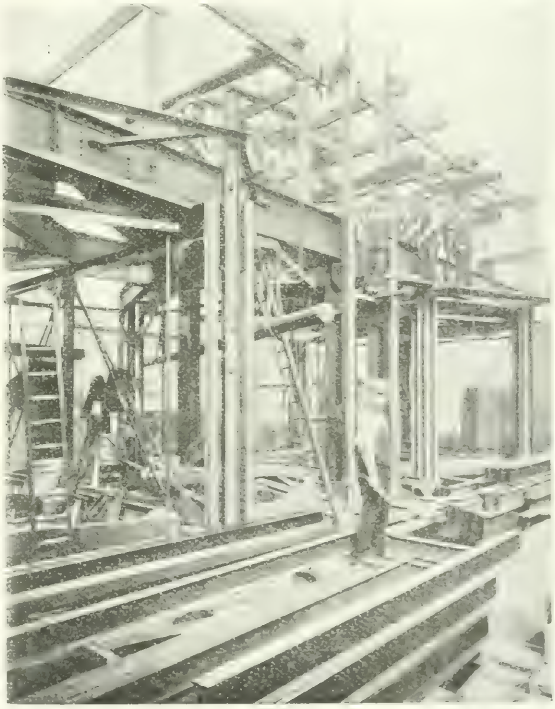
ONE of the largest installations of electrically driven hydraulic lifts erected by Messrs. R. Waygood and Co., Ltd., is to be found at the Shepherd's Bush Station of the Central London Railway, where they have now been running a sufficient time to entirely justify their introduction under the special conditions prevailing at this terminus.



PUMP CONTROLLER.

The four lifts are installed side by side, and are each capable of carrying from 60 to 70 passengers. They are contained in two wells, each about 23 ft. in diameter, and lined with cast iron segments, the total lift being 41 ft. 10 in. from the line to street level. Each lift has its own hydraulic jigger or multiplying cylinder, which is worked downward and is made with twin rams in separate cylinders, in order to economise space. The sheave frame at the lower end of each ram has two large multiplying sheaves, and there is also a frame secured to the top ends of the cylinders, which has one sheave. This arrangement gives a ratio of 4 to 1, the stroke being 10 ft. $5\frac{1}{2}$ in., in order to raise the cage 41 ft. 10 in.

Each cage is suspended by five steel wire ropes, any one of which is of ample strength to carry the maximum weight, so that the possibility of accident from breakage of ropes is extremely remote. To make assurance doubly sure, however, a very efficient safety apparatus is provided for each lift, consisting of two pairs of jaws which are attached to the cage, and by means of a special safety rope can be made to close securely upon the outside of two powerful rolled joists, and in any emergency would hold the cage securely in position. The two sets of three-throw plunger pumps are motor driven, each pump serving an accumulator weighted to a pressure of about 600 lb. per square inch, at the rate of 50 gallons per minute. The 40 brake-horsepower compound-wound motors run at a speed of 675 revolutions per minute, when working at 500 volts pressure under full loads. Each is provided with a special controller, and is operated by pilot switches.



FRAMEWORK OF CAGES.

The lifts travel at the rate of about 250 ft. per minute, and make the journey up and down in about 12 seconds. They work smoothly, and have already gained a reputation for easy starting and stopping.

TECHNICAL EDUCATION.

The Association of Technical Institutions.

An organisation which has been doing a good deal of useful work in an unobtrusive manner during the last ten years is the Association of Technical Institutions. Prof. J. Wertheimer, B.Sc., B.A., who inaugurated the Association, and was for a long period its hon. secretary, now acts as Chairman of the Council, while Mr. G. H. Pope, M.A., B.C.L., J.P., D.L., and Principal S. H. Wells, are respectively Treasurer and Secretary. As far back as 1893 it was felt that those engaged in the work of technical education ought to be in a position to speak collectively when necessary, hence the formation of the association. Its objects are : (*a*) To provide a medium for the interchange of ideas among its members ; (*b*) to influence, by combined action where desirable, Parliament, county councils, and other bodies concerned in promoting technical education ; (*c*) to promote the efficient organisation and management of technical institutions, facilitate concordant action among governing bodies, and aid the development of technical education throughout the United Kingdom.

Sir John Gorst, K.C., M.P., is the President of the Association. His predecessors in office were : Sir William Mather, M.P., the late Right Hon. A. J. Mundella, M.P., the Right Hon. Sir Bernhard Samuelson, Bart., F.R.S., the Right Hon. Earl Spencer, K.G., Sir Swire Smith, the Right Hon. Sir William Hart Dyke, Bart., M.P., the Right Hon. Lord Avebury, D.C.L., F.R.S., and Sir John Wolfe-Barry, K.C.B., F.R.S.

Industrial Education in Germany.

According to the United States Bureau of Statistics, the phenomenal success of the German Empire in manufactures and commerce is due in very large measure to its splendid system of education, particularly in the branches designed to aid manufactures and commerce. These are the industrial, art, technical, commercial, and commercial high schools. A series of reports on industrial education, covering the entire educational system of the empire, but laying particular stress on the schools that affect manufactures and commerce, has been prepared by Mr. Ernst C. Meyer, deputy United States consul at Chemnitz. This paper is the first of the series, which will be published in the following order : (1) The German system of education ; (2) The evolution of German schools ; (3) German industrial schools and their relation to German industrial life ; (4) Primary industrial continuation schools ; (5) Classification of German industrial schools ; (6) German textile schools ; (7) German schools for builders ; (8) The engineering schools of Prussia ; (9) German schools of technology ; (10) German mining schools ; (11) German navigation, shipbuilding, and naval engineering schools ; (12) German schools for woodworkers ; (13) General trade schools of Germany ; (14) German trade schools for women ; (15) Commercial schools of Germany ; (16) German schools for industrial art ; (17) Technical high schools of Germany ; (18) Administration of the German system of industrial education ; (19) Summary and criticism of German industrial educational system. Taken in connection with the series of reports on the German Empire which appeared a few months ago in the *Times*, the reports of Mr. Meyer will be found very suggestive.

Mining and Metallurgical Education.

One of the points brought out in the discussion of Mr. Jenkins' paper on the organisation of Mining and Metallurgical Education at the Institution of Mining and Metallurgy, was that a three years' course was far too short in which to cover all the ground that ought to be covered in a first-class School of Mines. From the standpoints not only of the teacher, but also that of a professional worker, Mr. Jenkins said he had for a long time been led to consider that the amount of time that a student has to spare for his studies was the most important of the factors that put a limit to the thoroughness of his preparation at the present day, and he noticed with some satisfaction the concensus of responsible opinion in the discussion that the courses of study suitable for the engineer to-day should cover at least four years instead of the three that have so far been by many persons considered to be sufficient.

The technical school was surely replacing much of the work of pupilage. It was becoming increasingly difficult for the conscientious master to discharge his full duties to pupils, owing to the complexity of modern work, and the pupil had to supplement the deficiency by his own effort. The tendency was for more and more of the work to pass to the schools.

Post-graduate courses in mines and works replaced the work that formerly was done by the master for his apprentice to some small extent, and was most valuable ; but, unfortunately, they could not apply to the great majority of cases. The author held with many of the speakers that a study of such subjects as works costs, or the management of men, belongs strictly to the sphere of industrial activity, and to a much more advanced stage of a man's career than the scholastic one.

LABOUR IN NOVEMBER.

BOARD OF TRADE returns show that employment in November was, on the whole, dull, and rather worse than a month ago. In the 274 Trade Unions with an aggregate membership of 577,268 making returns, 40,244 (or 7·0 per cent.) were reported as unemployed at the end of November, as compared with 6·8 per cent. at the end of October, and 6·0 per cent. at the end of November, 1903.

COAL MINING.

Employment in this industry continued moderate. The number of days worked by the collieries was less than in the November of any year since 1895. At collieries employing 541,071 workpeople, the pits worked an average of 5·14 days per week, as compared with 5·16 in October, and 5·24 in November, 1903. At the pits for which returns have been received the number of workpeople employed in November was rather larger than in both October, 1904, and November, 1903. The following table shows the average time worked by the pits in the various districts :—

District.	No. of Workpeople employed in Nov., 1904, at the Collieries included in the Table.	Average No. of Days worked per week by the Collieries in Four Weeks ended			Increase (+) or Decrease (−) in Nov., 1904, as compared with	
		Nov 26th, 1904.	Oct. 22nd, 1904.	Nov 21st, 1903.	A m'nth ago.	A year ago.
ENGLAND & WALES		Days.	Days.	Days.	Days	Days.
Northumberland	41,074	5·11	5·33	5·35	− ·22	− ·24
Durham	93,976	5·36	5·38	5·47	− ·02	− ·11
Cumberland	6,382	5·50	5·34	5·55	+ ·16	− ·05
South Yorkshire	62,040	5·07	5·23	5·25	− ·16	− ·18
West Yorkshire	19,924	4·40	4·78	4·62	− ·38	− ·22
Lancashire and Cheshire...	57,366	5·00	4·72	4·96	+ ·28	+ ·04
Derbyshire	36,917	4·49	4·57	4·68	− ·08	− ·19
Nottingham and Leicester	26,022	4·40	4·68	4·41	− ·28	− ·01
Staffordshire	25,926	5·11	4·79	5·22	+ ·32	− ·11
Salop, Worcester, and Warwick	10,106	5·10	5·31	4·71	− ·21	+ ·39
Gloucester and Somerset	8,453	5·08	5·18	5·21	− ·10	− ·13
North Wales	10,378	4·91	5·07	5·51	− ·16	− ·60
South Wales and Mon. ...	112,376	5·58	5·49	5·79	+ ·09	− ·21
ENGLAND & WALES ...	501,980	5·12	5·15	5·22	− ·03	− ·10
SCOTLAND.						
West Scotland	18,384	5·28	5·27	5·37	+ ·01	− ·09
The Lothians	4,926	5·74	5·75	5·61	− ·01	+ ·13
Fife	15,109	5·32	5·26	5·36	+ ·06	− ·04
SCOTLAND ...	38.419	5·35	5·33	5·40	+ ·02	− ·05
IRELAND. ...	672	5·32	4·88	5·32	+ ·44	...
United Kingdom ...	541,071	5·14	5·16	5·24	− ·02	− ·10

IRON MINING.

Employment in this industry continued good. At the 125 mines and open works covered by the returns received from employers, the average number of days worked per week during the four weeks ended 26th November was 5·86, as compared with 5·83 in October, and 5·74 a year ago. The number of workpeople employed was 1·8 per cent. greater than in October, and 2·2 per cent. greater than in the corresponding month a year ago. The following table summarises the returns received.

Districts.	No. employed in Nov., 1904, at the Mines included in the Table.	Average Number of Days worked per week by the Mines in 4 weeks ended			Increase (+) or Decrease (−) in Nov., 1904, as compared with	
		Nov. 26th, 1904.	Oct. 22nd, 1904.	Noy. 21st, 1903.	A month ago.	A year ago.
ENGLAND—						
Cumberland and Lancashire ...	4,658	Days. 5·95	Days 5·89	Days. 5·77	Days [illegible]	Days. + 0·18
Cleveland... ...	7,215	5·91	5·94	[illegible]	[illegible]	+ 0·09
Lincolnshire and Leicestershire...	946	5·82	5·77	[illegible]	[illegible]	[illegible]
Northamptonshire	596	5·83	5·81	[illegible]	[illegible]	[illegible]
Staffordshire and Shropshire ...	653	5·34	5·13	[illegible]	[illegible]	[illegible]
Other places in England ...	154	5·75	5·95	[illegible]	[illegible]	− 0·12
Total, England	14,222	5·88	5·86	5·71	+ 0·02	+ 0·17
SCOTLAND	1,008	5·53	5·53	[illegible]	[illegible]	[illegible]
IRELAND	125	5·94	5·74	[illegible]	[illegible]	[illegible]
Total and Averages	15,355	5·86	5·83	5·74	+ 0·03	+ 0·12

PIG IRON INDUSTRY.

Employment showed a further slight improvement, but it continued to be below the level of a year ago. Returns relating to the works of 108 ironmasters showed that 304 furnaces, employing about 21,400 workpeople, were in blast at the end of November, compared with 302 in October, and 314 a year ago. The following table shows by districts the number of furnaces in blast at the works included in the returns:—

Districts.	Number of Furnaces, included in the returns, in Blast at end of			Increase (+) or Decrease (−) in Nov., 1904, as compared with	
	Nov., 1904.	Oct., 1904.	Nov., 1903.	A month ago.	A year ago.
ENGLAND & WALES—					
Cleveland*	77	77	80	...	− 3
Cumberland & Lancs.	32	31	31	+ 1	+ 1
S. and S.W. Yorks.	13	13	15	...	− 2
Derby & Nottingham	36	36	38	...	− 2
Leicester, Lincoln, and Northampton	25	25	26	...	− 1
Stafford & Worcester	30	30	34	...	− 4
S.Wales & Monmouth	15	15	13	...	+ 2
Other districts ...	6	6	7	...	− 1
Returned from England & Wales	234	233	244	+ 1	−10
Returned from Scotland	70	69	70	+ 1	...
Total furnaces included in returns	304	302	314	+ 2	−10

IRON AND STEEL MANUFACTURE.

Employment showed little change as compared with a month and a year ago. Returns relating to 1940 works, employing 73,505 workpeople, showed a decrease in the total volume of employment during the week ended November 26th of 0·2 per cent. as compared with the corresponding week of October, and of 0·5 per cent. as compared with the corresponding week of November, 1903. The following table shows the changes in the number of workpeople employed at 194 works in Great Britain, which made returns to the department.

—	Number employed in week ended			Increase (+) or Decrease (−) in Nov., 1904, as compared with	
	Nov. 26th. 1904.	Oct. 22nd 1904.	Nov. 28th 1903.	A month ago.	A year ago.
England and Wales	61,676	61,923	62,986	− 247	− 1,310
Scotland	11,829	11,882	11,651	− 53	+ 178
Total	73,505	73,805	74,637	− 300	− 1,132

ENGINEERING TRADES.

Employment generally was dull. It was slightly better on the whole than a month ago, but was worse than a year ago. The percentage of unemployed Trade Union members at the end of November was 7·8, as compared with 7·9 at the end of October, and 6·0 at the end of November, 1903. The percentages for the various districts are shown in detail in the following table:—

District.	No. of Members of Unions at end of Nov., 1904, included in the returns.*	Percentage returned as Unemployed at end of			Increase (+) or Decrease (−) in percentage unemployed for Nov., 1904, as compared with a	
		Nov., 1904.	Oct., 1904.	Nov., 1903.	Month ago.	Year ago.
North-East Coast	14,205	8·4	7·6	7·5	+ 0·8	+ 0·9
Manchester and Liverpool District	17,436	9·3	9·7	6·1	− 0·4	+ 3·2
Oldham, Bolton, and Blackburn District	11,258	12·1	12·0	7·8	+ 0·1	+ 4·3
West Riding Towns	11,701	9·6	10·4	7·2	− 0·8	+ 2·4
Hull and Lincolnshire District	3,454	7·1	7·0	8·2	+ 0·1	− 1·1
Birmingham, Wolverhampton, and Coventry District	6,268	5·1	6·1	4·1	− 1·0	+ 1·0
Notts, Derby, and Leicester District	4,028	11·7	9·9	5·9	+ 1·8	+ 5·8
London and Neighbouring District	12,193	5·3	5·4	4·9	− 0·1	+ 0·4
South Coast	4,029	2·2	3·3	2·6	− 1·1	− 0·4
South Wales and Bristol District	6,482	5·1	5·5	4·0	− 0·4	+ 1·1
Glasgow and District ...	13,733	9·4	9·2	7·9	+ 0·2	+ 1·5
East of Scotland	3,604	11·1	11·1	8·8	..	+ 2·3
Belfast and Dublin	3,452	12·6	12·6	6·4	+ 0·4	+ 6·2
Other Districts	5,449	5·5	6·4	5·2	− 0·9	+ 0·3
United Kingdom (Including certain Unions for which district figures are not available)	144,036	7·8	7·9	6·0	− 0·1	+ 1·8

SHIPBUILDING TRADES.

Employment continued bad, and was slightly worse on the whole than a month ago, but slightly better than a year ago. The percentage of Trade Union members who were unemployed at the end of November was 16·6, as compared with 16·1 at the end of October, and 17·1 at the end of November, 1903. The following table shows in detail the percentages of unemployed Trade Union members in the various districts:—

District.	No. of Members of Unions at end of Nov., 1904 included in the returns.*	Percentage returned as Unemployed at end of			Increase (+) or Decrease (−) in Percentage for Nov., 1904, as compared with a	
		Nov., 1904.	Oct., 1904.	Nov., 1903.	Month ago.	Year ago.
Tyne and Blyth	9,352	17·3	16·0	17·8	+ 1·3	− 0·5
Wear	4,792	17·0	12·5	30·0	+ 4·5	− 13·0
Tees and Hartlepool	5,106	28·0	25·9	15·1	+ 2·1	+ 12·9
Humber	2,333	14·9	15·0	19·5	− 0·1	− 4·6
Thames and Medway	4,074	10·5	13·9	14·2	− 3·4	− 3·7
South Coast	3,855	3·5	5·2	6·6	− 1·7	− 3·1
Bristol Channel Ports	2,690	18·9	25·2	21·8	− 6·3	− 2·9
Mersey	4,[illegible]6	17·1	15·7	18·5	+ 1·4	− 1·4
Clyde	12,[illegible]	16·0	15·6	16·0	+ 0·4	—
Dundee, Leith, and Aberdeen ...	2,2[illegible]	27·3	26·9	33·7	+ 0·4	− 6·4
Belfast	2,[illegible]28	19·2	18·7	6·6	+ 0·5	+ 12·6
Other Districts	[illegible],12[illegible]	11·1	9·5	9·9	+ 1·6	+ 1·2
United Kingdom (Including certain Unions for which district figures are not available)	67,601	16·6	16·1	17·1	− 0·5	− 0·5

DOCK AND RIVERSIDE LABOUR.

Employment during November was moderate, about the same as a month ago, but worse than a year ago. The average number of labourers employed daily at the docks and principal wharves in London during the four weeks ended November 26th was 13,503, a decrease of 0·3 per cent. on the average for October, and of 10·8 per cent. on the average for November 1903.

THE WEEK AMONG THE TECHNICAL SOCIETIES.

MANCHESTER ASSOCIATION OF ENGINEERS.

THE ECONOMIC VALUE OF CAST IRON.

A PAPER on this subject was read before the last meeting of this Association by Mr. W. H. Pretty, A.M.Inst.C.E., of which the following is an abstract:—

Cast iron in various forms and qualities is a commodity so readily obtained in this country at the present time, that one is apt to forget its true economic value in the arts and industries in which it plays a part. This in its turn has led to an almost inexcusable neglect on the part of engineers and others of a most fascinating, valuable, and educational industry. At the same time, it is an aid in engineering work which cannot be despised. There are, however, many factors involved in the maintenance of standard qualities, and rendered more complex by the great range in quality and price of pig iron, etc., each of value for particular purposes, at the founder's disposal.

The pig irons produced at hot-blast furnaces are generally graded, as No. 1 to No. 4 foundry; No. 1 to No. 3 forge; mottled and white; and at cold-blast furnaces as No. 1 to No. 5; mottled and white. It would be far better to grade these irons by analysis, even if only approximately correct, and the author takes this opportunity for suggesting that a grading of pig irons by analysis, combined with a few physical and mechanical tests, is a fitting subject for research and inquiry by engineers who require iron castings for specific purposes. The author does not, however, wish to convey the impression that chemical analysis is the key to the situation.

The paper deals in a manner devised by the author with the changes in analysis in the various numbers of any particular brand of pig-iron, called by him the "Brand Characteristic," and found to be of much use in estimating the economic value of pig irons for various purposes. Each "Brand Characteristic" deals with one production only. It is interesting, says the author, to note the comparative uniformity of the sulphur and phosphorus in almost all the pigs of the same brand, and in some cases the manganese also: this is of special value in changing the number of the pig used in any mixture, and enables an estimate to be made of the effect of altering the percentage of the remaining elements and to select other brands, as required, possessing a different "Brand

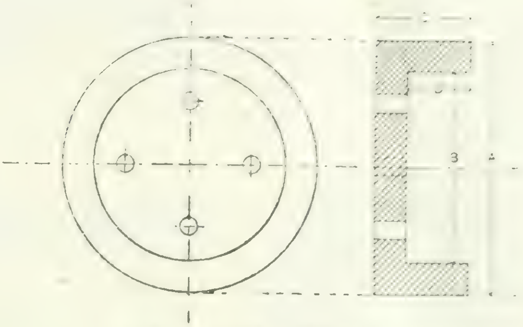


FIG. 1. TEST SPECIMEN.

Transverse test for cast iron only, standard bar 2in. deep, 1in wide, 3ft. between points of support, tested on edge with load at centre.

Number of Test.	Date of Casting.	Date of Making the Test.	Maker of Material	Breaking Load.			Deflection at centre in inches.	PIG IRON.			Weight of Iron in one Cupola Charge, Cwts.	COKE.			Air pressure of Blast at Cupola in inches of Mercury.	Furnace used.	Purpose Metal is intended for.	Remarks.
				Cwts.	Qrs.	Lbs.		Brand and No.	Hot or Cold Blast.	Quantity of each in Cwts.		Brand and Maker	Bed Coke, Cwts.	Coke per Charge Cwts.				

FIG. 2. FOUNDRY TEST SHEET.

Characteristic." The most variable elements are, graphitic carbon, combined carbon, and silicon. It is hardly necessary to dwell further upon these constituents, except to point out that by varying the elements mentioned, and by a suitable choice of pig iron and scrap, there can be produced a material of the greatest economic value in the service of mankind, and possessing the mechanical and physical properties which are necessary in the various arts and manufactures.

THE STANDARD OF COMPARISON.

Fig. 1 shows a "test specimen" used by the author, and the dimensions are as follows: For heavy work: A = 12 in.; B = 9 in.; C = 4 in.; D = 3 in.; for light work: A = 12 in.; B = 10½ in.; C = 4½ in.; D = 3½ in. These should always be cast in a dry mould, preferably a dry sand mould, to avoid any doubt upon the possibility of chilling. Holes can be drilled in the back as shown in the sketch, and to suit the "boring mill" used in the operation. It is important that the specimen be held as rigidly as possible.

Sufficient has perhaps been said to show the necessity of systematic work in the foundry, and of recording results from day to day. Fig. 2 represents a sheet drawn up for such a purpose by Messrs. Gimson and Co., Ltd.

Among other things it will be noticed that the standard transverse test bar and method of applying the load are carefully defined. This size of transverse test bar, viz., 2 in. deep by 1 in. wide by 3 ft. long between points of support, tested on edge with load at centre is an excellent one, and is rapidly gaining ground in this country as the standard of comparison.

MECHANICAL AND PHYSICAL TESTS.

The study of chemical analysis must, says the author, be combined with mechanical and physical tests, and he proceeds to consider them and their bearing upon the maintenance of good qualities of cast iron in the foundry, and the extension of its usefulness in various industries.

A few years ago, the author was engaged in investigating the question of strength in cast irons, its bearing upon the high cutting speeds now in vogue in modern machine tools, and also its relation to specifications of strength, etc., which had to be satisfied; this interesting work was complicated, inasmuch as it involved the tool room, machine departments, testing department, while last, but not least, the foundry, arises in this connection. Touching upon the question of hardness of cast iron and the cutting speeds required, or aimed at in the machine departments, the author always recommends that a standard test should be instituted for arriving at a mutual understanding on this point, a standard pattern being used for making up the test specimen which is to be subject to rigorous machine-shop tests, and the results properly recorded. Any dispute regarding the hardness of the metal can always be referred to such a machine-shop standard test. In connection with this it is necessary to have half-a-dozen carefully selected tools for turning, boring, and facing operations, and of the high speed class, and constructed with standard cutting angles and compared for uniformity after hardening. These should be put away as standards of reference only, from which other tools can be made for the actual cutting tests.

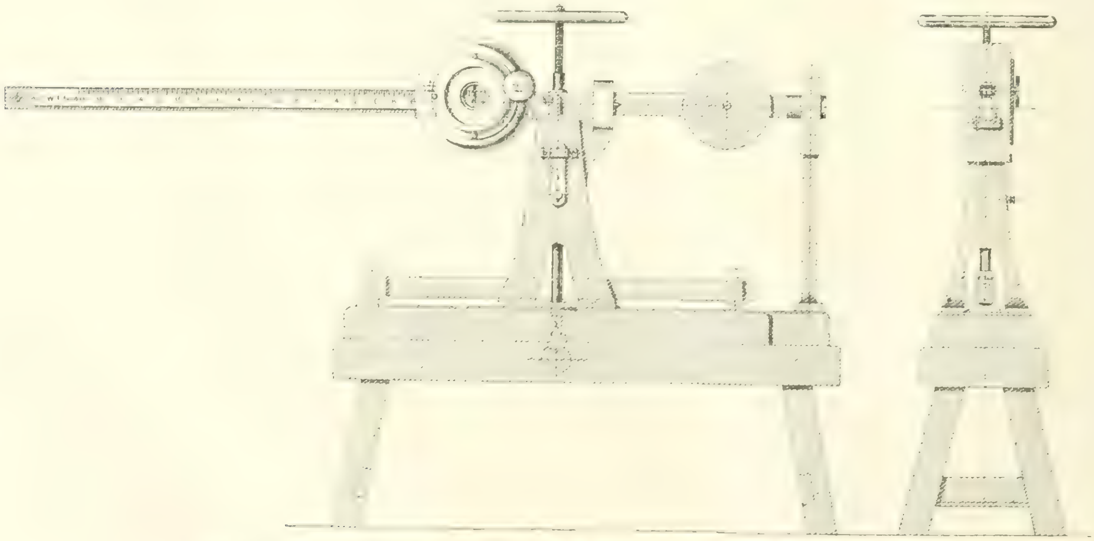


FIG. 3. BAILEY'S TRANSVERSE TESTING MACHINE. CAPACITY 40 CWT.

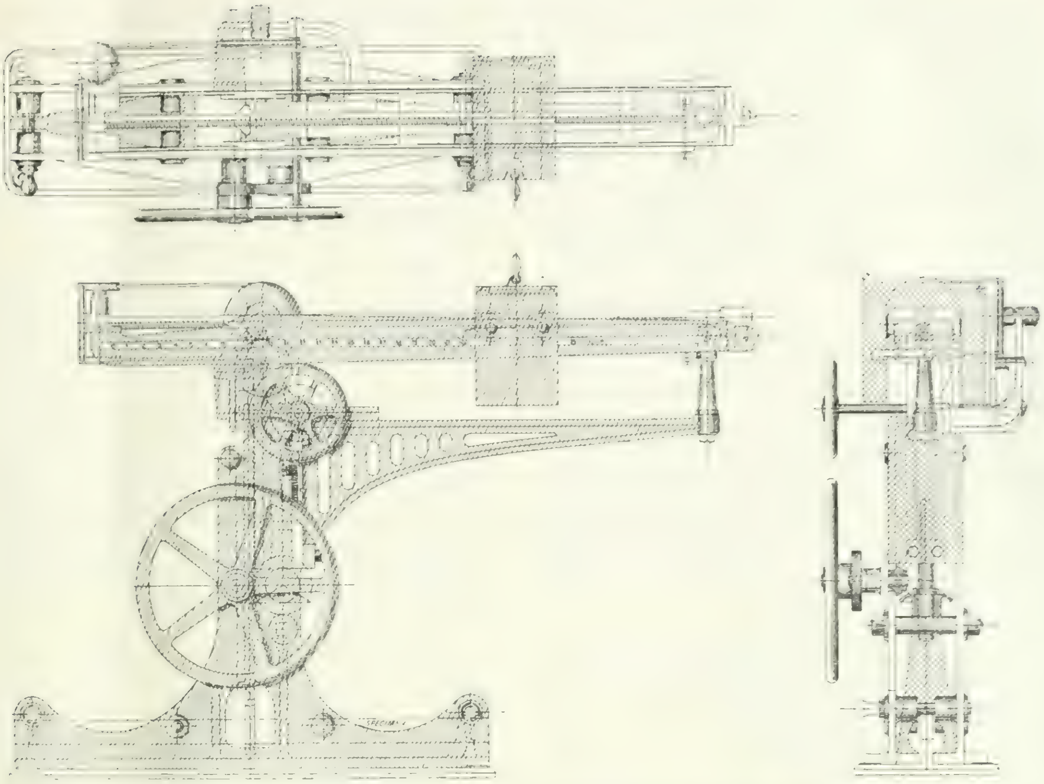


FIG. 4. S. DENISON AND SONS' TRANSVERSE TESTING MACHINE. CAPACITY 40 CWTS.

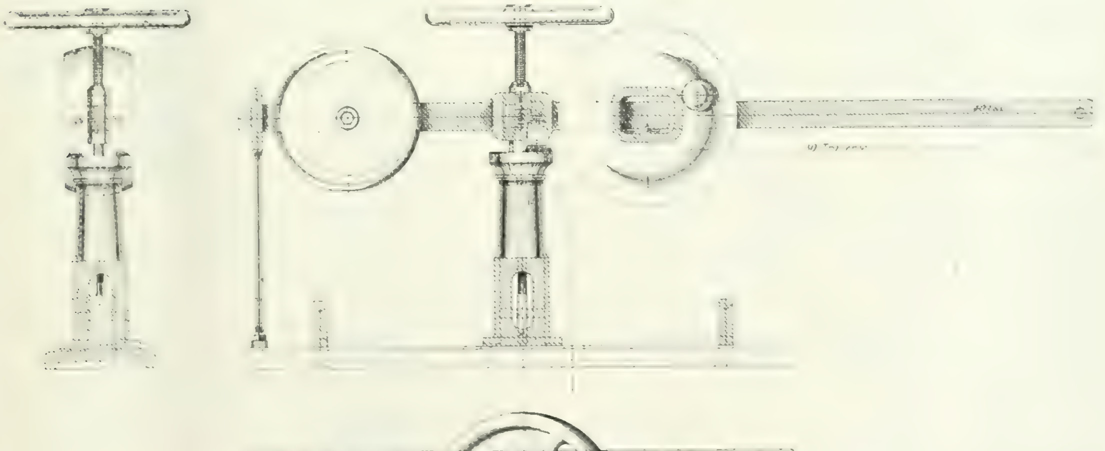


FIG. 5. AVERY'S TRANSVERSE TESTING MACHINE. CAPACITY 40 CWTS.

SYSTEMATIC TESTING.

Such a standard test is of no mean value in determining the economic value of a cast iron for machine shop purposes, a point too often missed in dealing with castings of varying order of rigidity. The design of the casting forms an important factor in the vibration set up between the materials and tools when cutting at high speeds, and such a test isolates the "metal" from the "moulding design," and also the method of supporting the work when being machined.

Fig. 3 is an illustration of a foundry testing machine made by William H. Bailey and Co., Ltd., Salford, Manchester, and shows a front elevation, end elevation, and plan. This machine has several good points; it is very simple in construction; an eye bolt is placed immediately under the machine, which enables a dead-weight test to be applied to check the readings at any time, as may be desired, and arrangements are made to enable the bar under test to be placed at once accurately to the standard condition of length and central application of the load.

Fig. 4 gives the details of a testing machine made by Messrs. Samuel Denison and Sons, Hunslet Foundry, Leeds. This is also an excellent machine for the foundry, and several improvements have been recently introduced.

Fig. 5 illustrates a foundry testing machine, made by Messrs. W. and T. Avery's, Ltd., Soho Works, Birmingham. All these machines are of two tons or 40 cwt. capacity, and in each, arrangements are made for taking the deflection of the bars under varying loads.

It will thus be seen that there are makers of repute who have grasped the importance of the systematic testing of cast iron. In the author's opinion these machines should have their capacity increased to 50 cwt., as he has on many occasions been unable to break the standard bars defined above with a load of 40 cwt. In connection with this transverse test it may be pointed out that the frequent reference of such a test to tons per square inch of cross section should be discarded, as the stresses produced are peculiar to the method of testing and the form of section used.

The tensile test would also be very carefully defined under standard conditions if the results are to be in any way comparable. The author is of opinion that a circular section is most satisfactory for this test, as it enables ready comparison between turned and cast specimens to be made. They should be cast as nearly as possible to the standard test size in every case.

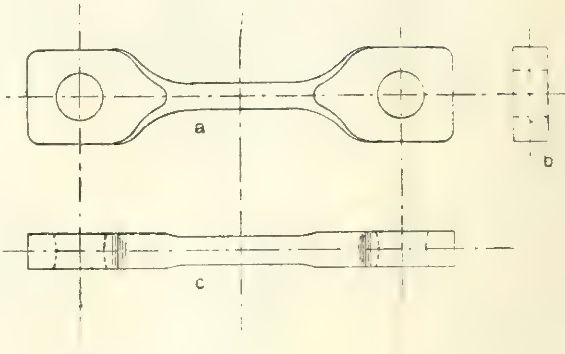


FIG. 6. PATTERN OF TEST-PIECE AS RECEIVED FROM FOUNDRY,

Designed to get a longitudinal pull free from bending moment.

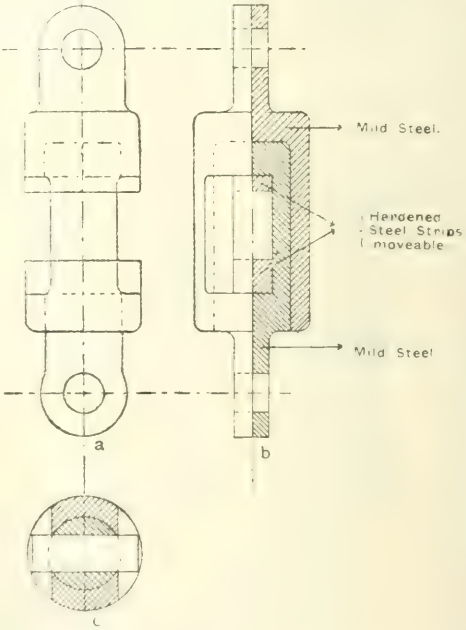


FIG. 7. FORM OF COMPRESSION APPARATUS FOR SMALL PILLARS,

For use in machines made for tensile tests.

SPECIAL TESTING MACHINES DESCRIBED.

Fig. 6 a b c is a good pattern of test piece as received from the foundry. It is designed to get a longitudinal pull free from bending moment, and the holes are cambered with this object in view. To ensure alignment of core holes with the longitudinal axis, they must be tested on a jig after casting. The cheap form of such a test piece goes far to encourage its use, while the results obtained are very uniform and satisfactory. This particular test has a diameter of ·564 in. giving a sectional area of ·25 square inch. It is intended for foundry purposes, and is broken as received from the foundry without being machined. Simple multiplication by four of the actual breaking load gives the required tensile strength per square inch of the specimen.

Fig. 7 a b c shows a form of compression apparatus used by the author for small pillars, for use in machines ordinarily made for tensile tests. It will be seen that the design guarantees an axial thrust on the test specimens at all times, side play in the end pieces being prevented.

A cast iron chill mould is shown in fig. 8, a b c, a form used by the author for obtaining a little definite knowledge of the nature of the fluid iron waiting to be poured into the mould and before pouring.

This test is of great value in judging the relative hardness and other qualities of the metal used from day to day. Abnormal conditions of melting are readily detected also. Interesting chills are sometimes obtained, showing gases apparently liberated within the mass. The dimensions of the chill must necessarily be kept standard for comparative purposes, the sizes chosen being as follows: The interior dimensions of the mould are 9 in. by 2 in. at surface, and 8 in. by 1 in. at bottom of mould, by 2 in. deep, the sides of the mould being 1 in. thick throughout.

The question of temperatures and cooling curves determined in the ladle, or a special mould is important; but tests are complicated by the corrosive action of the metal and slags upon the delicate thermo-metric apparatus. To overcome this, the author has suggested to Professor Callendar the use of tubes, such as shown in fig. 9 a b in conjunction with his thermometers, the thermometer being inserted into the interior, and thus kept out of direct contact with corrosive slags and irons. These tubes are made of a very compact form of carbon, such as is used for arc lamp carbons, and oxidised very slowly.

EFFECT PRODUCED BY VARIATION.

It may be of interest here to note that the higher class and more costly irons are very uniform in their superior strength. Selection can also accomplish much. The author has raised a mixture from a tensile strength of 12 tons per square inch to 18 tons per square inch, by carefully selecting the pigs already in use, and without changing the total pig iron used per charge by careful attention to detail in working the furnaces, the formation of proper slags, etc., and the daily check made possible by the use of sheets such as are represented by Fig. 2.

In conclusion the author refers to the physical properties of cast iron and the effects produced by variation in melting and casting condition, the addition of minute quantities of other elements, or by after treatment in the solid state; perhaps the most fascinating work in the whole field of new discovery. It is very difficult to say when physical conditions end and chemical conditions begin; truly speaking they are mingled to such an extent as to suggest chemical physics or physical chemistry as a good basis for future work.

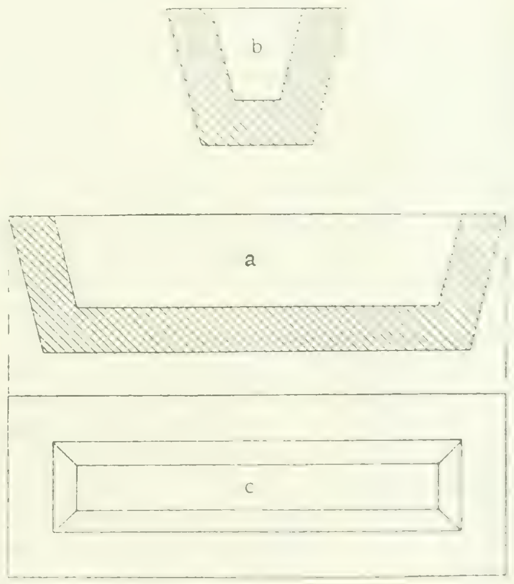


FIG. 8. CAST IRON CHILL MOULD A B C.

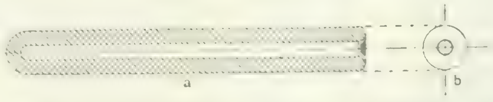


FIG. 9. CARBON TUBE USED IN CONJUNCTION WITH THERMOMETER.

THE INSTITUTION OF MINING AND METALLURGY.

CAUSE OF MINER'S PHTHISIS.

The third ordinary meeting of the session was held at the rooms of the Geological Society, Burlington House, Piccadilly, London, W., on Dec. 15. The following papers were down for discussion: "The Dust in the Air and the Gases from Explosives in a Cornish Mine (Dolcoath), and the Efficacy of Methods of Dealing with Them," by Messrs. R. Arthur Thomas and W. P. O. Macqueen; "The Permanganate Chlorination Process at Bethanga," by E. Harris; "St. David's Gold Mine, North Wales," by Mr. L. H. L. Huddart; "A New Slag Car," by Messrs. B. H. Bennetts and L. J. W. Jones.

The investigation made by Messrs. Thomas and Macqueen was undertaken with the view to clearing up certain disputed points in connection with the alleged causes of miners' phthisis. The points covered by the inquiry were as to the amount of stone dust present in the air during different operations in the Dolcoath mine; the efficacy of the water jets for preventing the formation of dust, and the amount of the chief gaseous impurities present in the air after the use of the ordinary gelatine dynamite used for blasting in Cornish mines.

The results of the inquiry may be briefly summarised. In drilling dry holes with machine drills the average of fifteen determinations gave 4·6 mg. in 10 litres of air; in drilling downward with machine drills with water thrown in from can, the average quantity of dust found in the air was 2·2 mg. per 10 litres. In drilling holes with machine drills the use of a water jet entirely prevents the formation of dust, provided the jet is used from the outset and is properly directed, but it is difficult to use the jet to the best advantage. The employment of a coarse spray in connection with machine drills is also efficient in stopping dust, a Mackenzie spray giving excellent results. The consumption of water by such a spray is very considerably less than with a jet, and the advantages of this are obvious.

DUST IN HAND DRILLING.

In hand drilling the amount of dust in suspension and liable to be inhaled, is considerable in comparison with that in a point being developed by rock drills which bore a far greater footage in a given time. Moreover, as the holes drilled in stopping are usually 4 ft. deep and over, and are almost always water holes after about the first 2 in., not more than one-twentieth as much dust is produced as from a dry hole of the same depth drilled by a rock drill. In places where hand drilling is carried on there is usually also sufficient ventilation to greatly dilute the dust, whereas in confined spaces the contrary is generally the case.

In shovelling, filling, and rock-breaking operations, when no means were taken to damp the broken ore or granite, a considerable quantity—varying from 0·6 to 3·4 mg. in 10 litres—of dust was present in the air. When, however, the ore had been previously damped by the use of James' water blast, no dust was present in the air. The water blast thus serves the purpose of damping the rock broken in ends or rises, as well as of drowning down the dust and smoke from blasting.

In blasting operations in ends and rises, experiments show that without any compressed air being blown in or special means taken for ventilation, the rate of settling is slow, and clearly proves that upwards of half-an-hour should elapse before the men should be allowed to return, unless wearing an efficient respirator.

GASEOUS IMPURITIES AFTER BLASTING.

Taking the average of all the samples, and allowing for the CO_2 present in the air just before blasting, the proportion of CO and CO_2 formed in blasting was 1 to 12. In the explosion of gelignite CO_2 and N_2 are liberated in such proportions that for every 1 per cent. of CO_2 formed, the oxygen will be diminished by about 0·33 per cent. This is assumed in calculating the ratio of CO to CO_2 from blasting. It is also assumed that the ratio between the CO_2 and diminution of oxygen from other causes remains the same before and after blasting. The smell of nitrous fumes was never detected. The highest percentage of CO met with was 0·24, along with 2·75 per cent. of CO_2. This was in a rise immediately after blasting.

By the use of the James' apparatus, which throws in a blast of air and water, the percentage of CO was at once reduced from a third to a fifth of what is was previously.

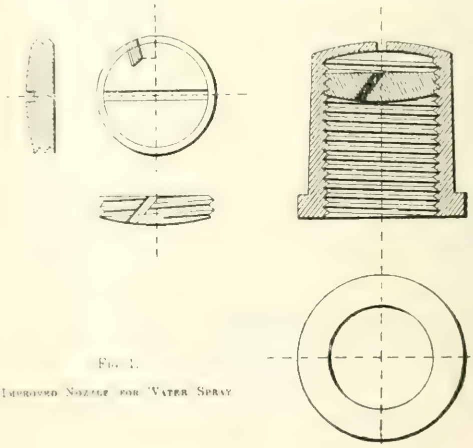


Fig. 1.

Improved Nozzle for Water Spray

SOCIETY OF ENGINEERS.

THE fiftieth annual general meeting of the Society of Engineers was held on Monday, December 12th, 1904, at the offices of the Society, 17, Victoria street, Westminster.

The chair was occupied by Mr. D. B. Butler, president. The following gentlemen were duly elected by ballot, as the Council and officers for 1905, viz.: As president, Mr. Nicholas James West; as vice-presidents, Messrs. Maurice Wilson, Richard St. George Moore, and Joseph William Wilson; as ordinary members of council, Messrs. Joseph Bernays, George Abraham Goodwin, George Green, William Henry Holttum, Edward John Silcock, Diogo Andrew Symons, John Aird, and Alexander Graham Drury; as honorary secretary and treasurer, Mr. George Burt; as honorary auditor, Mr. Samuel Wood, F.C.A.

The President announced that the following premiums had been awarded by the Council for papers read during the past session, viz.: The president's gold medal, to Mr. William Edward Storey for his paper on "Condensing Machinery"; the Bessemer Premium of books to Mr. R. G. Allanson-Winn for his paper on "Deep Sea Erosion and Foreshore Protection"; a society's premium of books to Mr. A. S. E. Ackermann for his paper on "British and American Coal-cutting Machines"; and a society's premium of books to Mr. Frank Latham for his paper on "Some Recent Works of Water Supply at Penzance."

THE ANNUAL DINNER.

The Jubilee Dinner was held on Wednesday, 14th inst., at the Hotel Cecil. Mr. D. B. Butler, the president, occupied the chair, and among those present were Sir William White (past-president Institution of Civil Engineers), Admiral Sir John Colomb, M.P., Sir William Christie, C.B., F.R.S. (astronomer royal), Mr. Hennen Jennings (president of the Institution of Mining and Metallurgy), Mr. Nicholas J. West (president-elect), Mr. J. W. Wilson and Mr. Morris Wilson (vice-presidents), and Mr. Perry F. Nursey (secretary).

The occasion of the fiftieth dinner is opportune for a brief record of the history of the Association. Established in 1854, it was originally known as the Putney Club, but in 1857 adopted the present title. At that time the membership was only 54, it is now 555. The year 1863 witnessed the institution of the class of honorary members, although none were elected until 1865. Amongst the earliest honorary members were Lord Playfair, Sir William Fairbairn, Sir John Herschel, Sir Joseph Whitworth, Dr. Percy and Professor Macquorn Rankine.

In all, the Society has published forty-four volumes of "Transactions" embodying [illegible] papers.

The toast of "The Society of Engineers" was proposed by Sir William Christie and briefly acknowledged by the President, who said that the Society had always made a point of offering encouragement to the younger members of the profession.

Mr. Nicholas J. West (president-elect), proposed the toast of "Kindred Institutions," which was responded to by Sir William White.

Mr. Maurice Wilson (vice-president), proposed the toast of "Our Guests," which was acknowledged by Mr. Hennen Jennings, the president of the Institution of Mining and Metallurgy.

The President proposed "The Secretary". Mr. Perry F. Nursey in response said if he understood Sir William White to have advocated the union of engineering societies he was in hearty accord with that suggestion.

The Metropolitan Association of Electric Tramway Managers is a new institution, the formation of which was decided upon at a meeting of tramway managers held at the Municipal and County Club. The membership area will cover the county of London, Croydon, Bexley, Erith, West Ham, East Ham, Ilford, Barking, Leyton, Walthamstow, South Middlesex, and other districts in close proximity to London where electric tramways are being developed, either by municipalities or companies. Mr. A. L. C. Fell, chief officer of the London County Council tramways, was elected chairman, and Mr. H. E. Blain, tramways manager, West Ham Corporation, hon. secretary. The Association justifies its separate existence by the fact that its sphere of operation will be confined to the metropolitan area and that its interests will not therefore clash with those of older associations.

Among the papers recently read before the members of the Electrical Association of New South Wales, have been "On the Construction and Maintenance of Overhead Wires," by Mr. R. D. Dixon, and "The Regenerative System of Electric Tram-car Control," by Mr. Oswald Haes.

A paper has been read before the Queensland Electrical Association, "Notes on Recent Telephone Systems," by the President, Mr. John Hesketh.

Launches and Trial Trips.

THE LARGEST AUSTRIAN CARGO STEAMER.

ON Thursday last, the finely-modelled steel screw steamer *Filippo Artelli*, built by the Northumberland Shipbuilding Company, Ltd., Howden-on-Tyne, the largest cargo steamer owned in Austria, and the largest vessel yet built for the Mediterranean trade, left the Tyne for her trial trip. Her dimensions are 430 ft. in length, 54 ft. extreme beam, and 32 ft. 2 in. moulded depth. She is designed to carry 9,000 tons deadweight on a moderate draft, with space for about 14,000 tons of measurement cargo, and is built on the deep frame principle, which, while giving great strength to the structure, leaves the holds clear for the stowing and discharging of bulky cargoes. Powerful machinery has been supplied by Messrs. The North Eastern Marine Engineering Company, Ltd., Wallsend-on-Tyne, with cylinders 27 in., 45 in., 74 in. by 48 in. stroke, and three large steel boilers working at 180 lb. pressure, capable of giving the vessel a speed of 11 knots loaded. The trial trip proved in every way satisfactory, a speed of over 11 knots being easily obtained. After the trial trip, the s.s. *Filippo Artelli* sailed under the command of Captain Badenicie for Trieste, with a full cargo of about 9,000 tons of coal, including bunkers.

THE TYNE.

There has been launched from Messrs. Jos. T. Eltringham and Co.'s Stone Quay Shipyard, at South Shields, a finely modelled screw tug, built to the order of The Manchester Ship Canal Company, for their Bridgewater department. The vessel is 100 ft. long by 19 ft. beam by 9 ft. depth, and takes the highest class at Lloyd's. The engines, which have been constructed by Mr. G. T. Grey, at the Holborn Engine Works, are of the compound type, and fitted with steam reversing gear. Steam is supplied by an extra-large boiler, also built by Messrs. Eltringham, and working at 140 lb. pressure. This is the fifth screw tug built by the same firm for the Manchester Ship Canal Company.

The powerful steel twin screw tug, *Lady Curzon*, recently launched from the building yard of Messrs. J. P. Rennoldson and Sons, South Shields, has had her official trial trip. The principal dimensions of this vessel are: Length, 120 ft.; breadth, 25 ft.; depth, moulded, 13 ft.; built under special survey and classed 100 A1 at Lloyd's. There is provided a full equipment of deck machinery of the latest type. The propelling machinery (which has been supplied by the builders) consists of two independent sets of compound surface condensing engines, having cylinders 18 in. by 38 in. diameter by 24 in. stroke, direct steam reversing, gear, and all recent improvements steam being applied by one specially large marine-type boiler, working at 120 lb. pressure. The results of the trial were quite satisfactory, several runs being made over the measured knot at Whitley, and, notwithstanding the prevalence of a very heavy sea, a mean speed of nearly 13 knots was attained. The *Lady Curzon* has been built to the order of the Dover Harbour Board where she is to,be specially employed in attending the large mail steamers now frequenting that port.

On Thursday last the new steel screw steamer *Arrival*, built by Messrs. Wood, Skinner, and Co., Ltd., of Bill Quay-on-Tyne, to the order of Mr. C. Rowbotham, of London, left the Tyne for her official trial trip. This vessel is of the raised quarter-deck type, with bridge and topgallant forecastle, and has been constructed to carry about 400 tons deadweight on a light draught of water. The propelling machinery, which has been constructed by Messrs. The North Eastern Marine Engineering Company, Ltd., at their Northumberland Engine Works, Wallsend-on-Tyne, consists of a set of triple expansion engines, having cylinders 13 in., 21 in., and 35 in., with a stroke of 24 in., steam being supplied by one steel boiler, working at a pressure of 180 lb. On the run over the measured mile off the Tyne, the machinery worked without the slightest hitch, the speed being in excess of contract.

THE WEAR.

On Saturday last, the new steamer *Bagdale*, built by Messrs. Robert Thompson and Sons, Southwick Yard, Sunderland, for Messrs. Thomas Smailes and Son, of Whitby, proceeded to sea for her official trial. Her dimensions are: Length, 336 ft.; breadth, 48 ft. 6 in.; and depth, moulded, 24 ft.; and she is built to Lloyd's highest class. The engines are by Messrs. The North Eastern Marine Engineering Company, Ltd., Sunderland. After adjusting compasses, the vessel proceeded to Cardiff to load for the River Plate.

HARTLEPOOL.

On Saturday last the large steel screw steamer *Pontop* proceeded on her official trial trip in Hartlepool Bay, after adjusting compasses. The vessel is over 335 ft. in length, and has been built for Messrs. The Peareth Steamship Company, Ltd. She is built on the deep frame principle, with poop, bridge, and forecastle, is of the single-deck type, and is classed 100 A1 at Lloyd's. The machinery, which has been supplied and fitted by Messrs. Richardsons, Westgarth, and Co., Ltd., Hartlepool, ran most efficiently, a speed of 12 knots being obtained. The sizes of cylinders are 23½ in., 38 in., 64 in. by 42 in. stroke, with two single-ended boilers 15 ft. 3 in. by 10 ft. 6 in. long, 180 lb. pressure. The vessel afterwards proceeded to Fowey to load,

CONTRACTORS' NEWS.

We shall be pleased to insert under this column, free of charge, particulars of open contracts.

CONTRACTS OPEN.

	Last Day
Rochdale.—Supply, delivery, and erection of high-tension three-phase switch-gear, and low-tension continuous current switch-gear for the Corporation. Mr. W. H. Hickson, Town Clerk … … …	Dec. 27
Linslade.—Construction of sewage works. Mr. N. J. Platten, Clerk, Linslade, Leighton Buzzard … … … …	Dec. 28
Bristol.—Construction, delivery, and maintenance for six months after completion of two steel hopper barges, each 55 feet long, 15 ft. 6 in. broad, and 6 ft. 6 in. deep, for the Docks Committee. Particulars of Engineer; tender to Secretary, Docks Committee, 19, Owen Square, Bristol …	Dec. 29
Mansfield.—Construction of Sewage Works. Mr. J. E. Alcock, Clerk … … …	Jan. 2
Cricklade.—Construction and maintenance of works for supplying Cricklade with water. Mr. H. Bevir, Clerk, Cricklade and Wootton Bassett District Rural Council, Wootton Bassett … … …	Jan. 3
Great Western Railway.—Supply and delivery of materials in connection with the electrical equipment of the Hammersmith and City Railway. Mr. G. K. Mills, Secretary, Paddington Station, London …	Jan. 3
Tottenham, London.—Provision and laying of 30-in. cast-iron pumping main for the Tottenham and Wood Green Joint Drainage Committee. Mr. Edward Crowne, Clerk, Tottenham… … …	Jan. 3
East Indian Railway.—Supply and delivery of steel material (plates, bars, joists, etc.). Mr. C. W. Young, Secretary, Nicholas Lane, London, E.C. … …	Jan. 4
Erith.—Four contracts in connection with the Electric Tramways. Particulars of Messrs. Hawtayne and Zeden, 6, Queen Street Place, London, E.C. Tenders to Mr. C. H. Fry, Clerk … … …	Jan. 9
Glasgow.—Supply of steel work for the renewal of superstructures of the seven water spans of Esk Viaduct, for the Caledonian Railway Company. Mr. J. Blackburn, Secretary, Buchanan Street, Glasgow …	Jan. 9
Stockport.—Supply and delivery of about 1,300 tons of grooved steel girder tramway rails, 24 tons of tiebars, 43 tons of fishplates, and 1,480 anchor joints for the Corporation. Mr. Robert Hyde, Town Clerk … … … … …	Jan. 9
Belfast.—Supply and erection at new infectious diseases hospital, of boilers and electric light installations, including engines, dynamos, etc. Mr. Samuel Black, Town Clerk … … … … …	Jan. 12
Bettws-y-coed.—Construction of waterworks extensions, about seven miles, and an embankment. Mr. E. R. Owen, Union Offices, Llanwrst … … … …	Jan. 12
Spain.—Supply of revolving platforms (Contract 1), steel rails (Contract 2). in connection with the improvements at the Port of Valencia. Particulars of the Commercial Intelligence Branch, Board of Trade, 73, Basinghall Street. Tenders to Port Administration, Valencia …	Jan. 10 & Jan. 14
Port Elizabeth.—Supply of materials in connection with Corporation Electricity Supply Works. Section A: Boiler-house plant; Section B: Engine-room plant; Section C: Electricity supply mains; Section D: Accumulators and boosters; Section E: Switchboards and instruments; Section F: Cranes; Section G: Public Lighting; Section H: Meters; Section I: Workshop equipment. Messrs. Davis and Soper, Agents, 54, St. Mary Axe, London, E.C. … … …	Jan. 26
Edinburgh.—Supply of gas plant and appliances, including gas exhausters and engines, water tube condensers, Pelouze and Audonin condensers, etc., for Edinburgh and Leith Corporations. Mr. James McG. Jack, 25, Waterloo Place, Edinburgh	Jan. 30
Caen (France).—Tenders for concession of a tramway from Ryes to Caen via Creully for goods and passengers. Particulars from the Prefect of Calvedos, Caen … … … … … …	Feb. 2
Leeds.—Supply of 750 tons straight and 100 tons curved section steel girder rails, for the Tramways Committee. Forms may be obtained from Mr. J. B. Hamilton, general manager, Standard-buildings, City-square, Leeds … … … … … …	
London.—Supply of a first-class new steel Lancashire boiler, 26 ft. long by 7 ft. diameter, constructed for a working steam pressure of 100 lb., to the Chelsea Infirmary, for the Guardians. Forms of Mr. Joshua Dowling, clerk, Guardians' Offices, 250, King's-road, Chelsea … …	

COMING CONTRACTS.

Spain.—The "Gaceta de Madrid" of the 6th December notifies an application by the "Compania General de Tranvias" for the concession of an electric tramway from Sans to Coll-Blanch.

Austria-Hungary.—The "Bulletin Commercial" (Brussels) states that the following public works are projected in Hungary:—The provision of a water supply in the districts of Lipto-Szent-Miklos, Zircz, Uj-Szegd, Lucsky, and Kecskemét. The construction of a railway from Baja to Battaszék, which will establish communication between the principal eastern and western lines of the Hungarian State Railways. The construction of a bridge across the Danube near Baja: the Budget for 1905 provides for the expenditure of 2,500,000 crowns (about £100,000) on this work.

Portugal—Mozambique.—The "Boletin Official," of the province of Mozambique, for the 11th November, contains copy of a Decree authorising the Government to proceed, in agreement with the Municipal Authorities of Lorenco Marques, to execute drainage works in that town. Public tenders will be called for the execution of this work in due course.

Norway.—The acting British Consul-General at Christiania reports that it has been decided to introduce a Bill into the Storthing to authorise the raising of a State loan of about 30,000,000 kroner (about £1,666,600), chiefly for the purpose of railway construction.

CONTRACTS CLOSED.

Welwyn.—The District Council has accepted the tender of Mr. R. M. Parkinson, of Peterborough, for the sewage contract, at the sum of £1,977.

Frinton-on-Sea.—The Council has accepted the tender of Messrs. Waghorn, Hull, for construction of sea wall, etc., at the sum of £23,467, for concrete work.

Bootle. The tender of Mr. W. Musker, Bootle, has been accepted for the construction and erection of steel-girder bridge over the Leeds and Liverpool Canal at the sum of £3,629.

Admiralty.—Orders have been given for several portable electric pumps to Messrs. Merryweather and Sons.

Monte Video.—The tender of J. G. White and Co., Ltd., has been accepted at the sum of £450,000 for the reconstruction of the tramways.

Yarmouth.—The Yarmouth Town Council decided, by a large majority, this week to accept a Belgian tender for between 800 and 900 tons of steel rails for the new electric tramways, at 95s. per ton, the lowest English tender being at 104s. 6d. per ton.

Alloa.—The British Electric Plant Company, Ltd., of Alloa, have been awarded by the Alloa Coal Company the contract for a complete electric-power plant on the direct-current system for their Bannockburn collieries.

Shanghai-Nanking Railway.—The contract to supply two powerful steam permanent-way breakdown cranes has been given to John H. Wilson and Co., Ltd.

Admiralty.—The Admiralty have placed an order with Vickers, Sons, and Maxim, Ltd., for ten additional submarines of B 1 class, one of which went through highly successful evolutions recently in deep water outside Barrow Harbour. The new submarines embrace all the improvements suggested to Capt. Bacon and other Admiralty experts by the experience gained in trials and experiments made with the existing submarine flotilla.

G.N.R.—The directors of the Great Northern Railway Company, after having considered the designs submitted by several locomotive builders throughout Great Britain, have placed a contract with the Vulcan Foundry, Ltd., of Newton-le-Willows, Lancashire, for a large express locomotive of the four-cylinder compound type.

Leith.—The Town Council are recommended to accept the tender of the North-Eastern Steel Co. for rails and fishplates required for the construction of their tramways. The price is stated to be below £5 10s. per ton.

Lowestoft.—The Corporation have accepted the tender of Callender's Cable Co., Ltd., for the supply of 4,000 yards of feeder cable, and have also placed an order with W. F. Dennis and Co. for 1,000 yards of cable.

Stalybridge.—The Stalybridge, Hyde, Mossley and Dunkinfield Tramway and Electricity Board have accepted the tender of Underwood and Brother for joining the tramway with that of the Ashton-under-Lyne system; that of Dick, Kerr and Co. for overhead equipment; and of Cook and Son for heating apparatus for the car shed, stores, and fitting shops.

Cardiff.—The contract for constructing the Cardiff Railway Company's new line between Taff's Well and Treforest has been let to Messrs. Oliver and Son, contractors, of Victoria Street, Westminster.

Belfast.—Orders have been received by the North Eastern Steel Company for 10,000 tons of tram rails for Belfast.

APPOINTMENTS VACANT.

	Last Day.
Galway.—A lecturer in electrical engineering is required at Queen's College, Galway, early in January, 1905. Salary £125, with class fees. Applications to the registrar, Mr. Edward Townsend, M.A....	Dec. 31
Newcastle-upon-Tyne. — General Manager for Corporation Electric Tramways. Initial salary, £700	Jan. 7
Manchester.—Professor of Engineering in the Victoria University. Salary and fees guaranteed at not less than £1,000 per annum. Particulars from the Registrar	Feb. 15
Straits Settlements.—Superintendent of Works of Public Works Department. Salary £360, rising to £480. Application by letter to Crown Agents for the Colonies, Whitehall Gardens, London ...	Dec. 28

APPOINTMENTS FILLED.

Oldham.—Mr. Joseph Moore has been appointed junior assistant electrical engineer under the Oldham Corporation.

Kilmarnock.—Mr. A. H. Burbidge, who was resident engineer to Messrs. Kennedy and Jenkin during the construction of the Kilmarnock Corporation electric power works, has been appointed electrical engineer and tramway manager to the corporation of that town.

Hastings.—Mr. Philip H. Palmer has been elected president of the British Association of Waterworks Engineers for the year 1904-05. Mr. Palmer is borough surveyor and water engineer of Hastings.

Great Eastern Railway.—Mr. H. G. Drury is about to retire from the position of chief superintendent of the Great Eastern Railway, a post he has occupied since 1897. He will be succeeded by Mr. R. P. Ellis, the present assistant superintendent. Mr. Drury entered the services of this line in 1853, when it was known as the Eastern Counties Railway.

Battersea.—Mr. John Henry Fooks Bale, resident electrical engineer, Mersey Railway, for the British Westinghouse Co. since 1902, was, on Wednesday, appointed electrical engineer to Battersea Borough Council at a commencing salary of £400 a year.

Middleton.—Mr. W. F. Endean, chief inspector of Devonport and District Tramways has been appointed manager of the Middleton Tramways.

Share List of Engineering, Electrical, Iron and Steel, and other Companies.

The following is a comprehensive list of Companies in the industries covered by "Page's Weekly," in which shares business is being currently transacted. Additions will be made from time to time as occasion requires. We desire it to be understood that while our Share List will generally be found correct, we do not hold ourselves responsible for any loss or inconvenience that may arise from possible inaccuracies.

Stock Exchange Settling Days.—Settling days on the Stock Exchange are as follows:—

Consols: January 5th. General Settlements: December 30th, January 13th, 27th. Bank Rate, April 21st, 3 per cent.

I.—ENGINEERING, IRON, AND STEEL COMPANIES.

Present Amount Subscribed.	Shares.	Last Dividend.	Name.	Paid up.	Closing Prices.
11,270	5	5%	Alldays & Onions Pneumatic Engineering, Ltd.	3	2¼ — 3
10,000	5	3/-	Do. Cum. Pref. 6 per cent. ..	5	4½ — 5*
80,000	Stk	4½%	Do. Mort. Deb. 4½%	100	98 —100
3,210,000	1	2/6	Armstrong (Sir W. G.), Whitworth and Co., Ltd.	1	3 — 3⅛
76,970	5	2/-	Do. 4% Cum. Pref.. ..	5	5⅜ — 5⅝
1,500,000	100	4%	Do. 4% 1st Mort. Dbs. Rd.	100	102 —104
£100,000	100	4½%	Aveling and Porter, Ltd., 4½% Reg. Mt. Debs. Red.	100	97 —100
530,000	1	1/7⅕	Babcock and Wilcox, Ltd., Ord. ..	1	3⅛ — 3¼
100,000	1	7⅕d.	Do. ,, 6% Cum. Pref.	1	1½ — 1⅝
20,000	5	3/-	Baker (Joseph) and Sons, Ltd., 6% Cum. Pref..	5	5 — 5½
250,000	1	6⅗d.	Baldwins, Ltd., 5½% Cum. Pref. ..	1	1 — 1⅛
£250,000	Stk	4½%	Do. 1st Mt. 4½% Deb. Stk. Red.	100	101 —103
150,000	4½	2/8⅖	Barrow Hæmatite Steel Co., Ld., O	4½	1 5/16 — 1 7/16
50,000	4½	6/-	Do. do. Cum 2nd. Pref.	4½	4 — 4½
33,334	5	2/6	Bayliss, Jones and Bayliss, Ltd., 5% Cum. Pref. Shares	5	4¾ — 5¼
£500,000	100	--	Beardmore (Wm.) & Co., Ltd., 4½% 1st Mt. Debs., Red., Scrip 50% pd	—	100 —102
50,000	10	6/-	Bell Brothers, Ltd., 6% Cum. Pref.	10	11¾ — 12¼
£366,600	Stk	4%	Do 4% Deb. Stock, Red.	100	100 —102
149,850	1	6d.	Bengal Iron and Steel Ord.	1	1 — 1⅛
200,000	1	1/-	Beyer, Peacock and Co., Ltd., Ord.	1	17/32 — 19/32
300,000	1	6⅗d.	Do. 5½% Cum Pref.	1	27/32 — 29/32
£300,000	Stk	4¼%	Do. 4¼% Red. Deb. Stock	100	96 — 99
1,629,760	1	6d.	Bolckow, Vaughan and Co., Ltd., O. Nos. 1-1,629,760	1	⅞ — 1 1/16
1,860,900	1	3⅗d.	Do. Nos. 1,639,101-3,500,000	12/-	17/32 — 19/32
1,160,000	1	4⅕d.	Brown (John) and Co., Lim., Ord., Nos. 1-1,160,000	15/-	1 3/16 — 1 5/16
590,000	1	6d.	Do. Ord., Nos. 1,160,001-1,750,000	1	1⅝ — 1¾
74,000	10	5/-	Do. 5% Cum. Pref.	10	11 —11¼*
154,500	5	2/6	Cammell, Laird & Co., Ltd., Ord. ..	5	7½ — 8
232,500	5	2/6	Do. 5% Cum. Pref. ..	5	5⅛ — 5¼
450,000	1	1/6	Clayton & Shuttleworth, Ltd., Ord.	1	⅞ — 1 1/16
70,000	5	2/6	Do. 5% Cum. Pref.	5	5¼ — 5½
£250,000	Stk	4%	Do. 4% 1st Mort. Db. Stk. Red	100	100 —102
100,000	10	30/-	Consett Iron Co., Ltd., Ord.. ..	7½	31 — 33
75,000	1	2/6	Delta Metal, Ltd. Shares	1	1⅞ — 2⅛
1,259,594	1	3⅗d.	Dorman, Long & Co., Ltd.	1	⅝ — ¾
£400,000	Stk	4%	Do. 4% 1st Mort. Perp. Deb. Stk.	100	92 — 95
£250,000	Stk	—	Do. 6% 2nd Mort. Deb. Stk, Red.	—	97 — 99
200,000	5	3/-	Dunderland Iron Ore Co., Ltd., 6% Cum. Pref. and Participating..	5	2¼ — 2¾
250,000	1	9⅗d.	Dunlop (James) & Co., Ltd., Ord...	1	9/16 — 11/16
300,000	1	7⅕d	Do. 6% Cum. Pref. ..	1	13/16 — 15/16
4,721	13	12/-	Ebbw Vale Steel, Iron & Coal Co., Ltd.	13	8½ — 9½
69,754	13	12/-	Do. do. do.	10	7 — 7¼
20,250	10	8/-	Elliott's Metal, Ltd.	8	4½ — 5½
5,000	10	5/-	Do. Cum. Pref. 5%	10	9 — 9½
186,748	Stk	4%	Do. Deb. 4%	100	95 — 100
25,000	10	6/-	Fairfield Shipbuilding & Engng. Co., Ltd., 6% Cum. Pref. ..	10	10½ — 11
£250,000	Stk	4½%	Do. 4½% Mort. Deb. Stk. Red.	100	99 —102
126,000	3	3/-	Fraser & Chalmers, Ltd., Ord. ..	3	4½ 5
21,000	3	4/6	Do. 7½% Cum. Pref.	3	5½ 6
965,000	1	1/-	Guest, Keen & Nettlefolds, Ltd. Ord.	1	2⅛ — 2¼
344,000	5	2/6	Do. 5% Cum. Pref.	5	5¾ — 6
£1,850,500	Stk	4%	Do. 4% Irred. Mort. Deb. Stk	100	105 - 107
13,000	5	2/6	Gwynnes, Ltd., 5% Cum. Pref. ..	5	2½ — 3½
250,000	1	1/-	Hadfield's Steel F'dry Co., Ld., Ord.	1	3 — 3⅛
20,000	10	4/6	Do. 4½% Cum. Pref.	10	10½ — 11
30,000	5	3/-	Hall (J. & E.), Ltd. 6% Cum. Pref...	5	5 — 5½
408,505	1	1/6	Harvey United Steel Co., Ltd. ..	1	1 1/16 — 1 3/16
28,001	5	7/-	Head, Wrightson & Co., Ltd. ..	5	4½ — 5
85,000	1	7⅕d.	Hill (Richard) & Co. (1899) Ld., Ord.	1	[illegible]
18,000	5	3/-	Do. 6% Cum. Pref.	5	4⅜ 4⅞
30,000	10	6/-	Hornsby (Richard) & Sons, Ld., Ord.	8	6 — 6½
750,000	1	10⅕d.	Howard & Bullough, Ltd., Ord. ..	1	1⅜ — 1⅝
25,000	10	6/-	Do. 6% Pref. (Non-Cum.) ..	10	12¾ — 13¼
£250,000	Stk	4%	Do. 4% Deb. Stk., Red. after 1905	100	96 — 99

ENGINEERING, IRON, AND STEEL COMPANIES.—*Contd.*

Present Amount Subscribed.	Shares.	Last Dividend.	Name.	Paid up.	Closing Prices
37,500	10	20	Kynoch, Ltd.	10	17¾ 18¾
49,537	10	5%	Do. Cum. Pref. 5%	10	10⅜ — 10⅝
300,000	1	4⅕d	Lambert Bros., Ltd., Ord.	1	⅝ — ⅞
50,000	5	2/9	Do. 5½% Cum. Pref.	5	4 — 4½
40,000	3	2/1½	Leeds Forge Co, 7% Cum. Pref. ..	3	3¾ — 4¼
200,000	1	7⅕d.	Lysaght (John), Ltd., 6% Cum. Pf.	1	1 5/16 — 1 7/16
£300,000	Stk	4½%	Do 4½% 1st Mt. Deb. Stk., Red.	100	110 —112
40,000	10	5/-	Mather & Platt, Ld., 5% Cum. Pref	10	11 11½
210,000	1	6d.	Measures Bros., Ltd, Ord.	1	9/16 - 11/16
75,000	1	6⅗d.	Do. 5½% Cum. Pref.	1	13/16 15/16
£75,000	Stk	4½%	Do. 4½% 1st Mrt. Db. Stk., Red.	100	96 - 99
21,943	5	2/6	Muntz Metal, Ltd.	5	4¾ 5¼
14,248	5	5%	Do. Pref. 5%	5	4⅞ 5⅜
5,000	62½	47/6	Nantyglo and Blaina Iron Works, Ltd., 8% Cum. Pref.	62½	73 — 75
73,000	10	5/-	N. Brit. Loco. Co., Ltd., 5% Cm. Pf.	10	11¾ — 12
80,000	5	—	North-Eastern Steel Co., Ltd., Ord.	5	
£250,000	Stk	4½%	Do. 4½% 1st Mrt. Db. Stk., Red.	100	92 — 95
122,000	5	2/-	Pearson & Knowles Coal and Iron Co., Ltd., Ord., "B"	5	3⅞ - 4⅛
50,000	5	3/-	Do. 6% Cum. Pref. "A" ...	5	5¾ - 6¼
70,000	10	6/-	Pease & Partners, Ltd., Ord. ..	10	8¾ - 9¼
£400,000	Stk	4%	Do. 4% Perp. Deb. Stock	100	97 —100
20,000	5	3/-	Peebles (Bruce) & Co., Ld., 6% Cm. P.	5	4¾ — 5
230,000	1	—	Projectile Co. (1902), Ltd., Ord. ..	1	⅜ — ½
126,938	5	2/-	Rhymney Iron Co., Ltd.	5	1⅛ - 1¼
73,062	5	2/-	Do. New	5	1⅜ - 1⅝
£330,000	--	5%	Do. 5% Mort. Deb., Red. ..	100	101 —104
350,000	1	7⅕d.	Richardsons, Westgarth & Co., Ltd., 6% Cum. Pf. ..	1	[illegible]
£350,000	Stk	4½%	Do. 4½% Perp. Deb. Stock ..	100	96 98
35,000	10	12/-	Ruston, Proctor & Co., Ltd... ..	10	9¼ — 9¾
275 000	1	6d.	Scott (Walter), Ltd., Ord.	1	13/16 — 15/16
300,000	1	7⅕d.	Do. 6% Cum. Pref. ..	1	1 — 1⅛
£300,000	Stk	4%	Do. 4% Perp. Deb. Stk.	100	95 — 97
£115,300	100	5%	Shelton Iron, Steel and Coal Co., Ld. 1st Charge 5% Debs.. Red ..	100	92 — 95
£97,900	100	6%	Do. 6% 2nd Mort. Debs., Red.	100	94 — 98
250,000	1	1/-	South Durham Steel & Iron, Ltd. Or.	1	½ ⅝
300,000	1	—	Do. 6% Cum. Pref...	1	⅞ — 15/16
£300,000	Stk	4½%	Do. 4½% Per. Deb. Stock	100	85 — 90
25,000	10	—	Stephenson (Robert) & Co., Ltd., Or.	10	1½ 1¾
25,000	10	5/6	Do. 5½% Cum. Pref. ..	10	3½ — 4
£250,000	Stk	4%	Do. 4% Perp. Deb. Stock	100	77 — 81
85,000	10	9/-	Stewarts & Lloyds, Ltd., Ord. ..	10	17 — 17½
55,000	10	6/-	Do. 6% Cum. Pref.	10	14 14½
634,732	1	4.69d.	Swan, Hunter & Wigham-Richardson, Lim. Ord.	1	⅞ — 1
538,845	1	6d.	Do. 5% Cum. Pref.	1	¾ — 13/16
£240,000	Stk	4¼%	Do. 4¼% 1st Mort. Deb. Stk. Red	100	98 —101
300,000	1	6d.	Thames Iron Works, Shipbuilding & Engineering Co., Ltd., 5% Cum. Pf.	1	½ [illegible]
£200,000	100	4%	Do. 4% Irredeem. 1st Mort. Deb.	100	67 — 71
£160,000	1	7⅕d.	Thornycroft (John I.) & Co., Ltd. 6% Cum. Pref.	1	15/16 — 1 1/16
10,000	10	5/-	Tylor (J.) & Sons, Ltd. 5% Cum. Pf.	10	9¾ 10¼
$508495200	$100	$½	United States Steel Corp. Com. Stk	$100	29⅞ 30⅛
$360314100	$100	$1¾	Do. 7% Cum. Pref. Stock	$100	94¼ 94¾
$162268000	$1000	5%	Do. 10-60yr. 5% Skg. Fd. G. Bds.	$1000	93 — 95
3,350,000	1	1/-	Vickers, Sons & Maxim, Ltd. Ord..	1	2 5/16 2 7/16
750,000	1	6d.	Do. 5% Non-Cum. Pref. ..	1	1⅛ 1¼
£750,000	Stk	5%	Do. 5% Non-Cum. Pref. Stock.	100	111 —114
£1,250,000	Stk	4%	Do. 4% 1st. Mort. Deb. Stk. Red.	100	103 —105
£1,000,000	100	4½%	Do. 4½% 2nd Mort. Debs.. Red.	100	103 —105
225,000	1	1/2½	Weardale Steel, Coal & Coke, Ltd., Def. Ord.	1	13/16 — 15/16
500,000	1	7⅕d.	Do. 6% Cum. Pref. Ord. ..	1	¾ 1
£300,000	Stk	4%	Do. 4% Perpetual Deb. Stock	100	85 — 89
7,637	5	2/9	Weldless Steel Tube, Ltd., Cum. Pref. 5%	5	4¼ 4¾
300	Stk	4½%	Do. Mort. Deb. 4½%	100	93 — 98
66,666	5	3/-	Willans & Robinson, Ord. . ..	5	1 — 2
66,666	5	3/-	Do. 6% Cum. Pref.	5	2 — 3
£246,641	Stk	4%	Do. 4% 1st Mort. Deb. Stk. Red	100	74 — 79
£150,000	Stk	4½%	Yorkshire Iron & Coal Co., Ltd., 4½% 1st Mort. Deb. Stk. Red.	100	80 — 85

Stocks and Shares marked are quoted ex-dividend.

ELECTRICAL MANUFACTURING COMPANIES.

Present Amount Subscribed.	Shares.	Last Dividend.	Name.	Paid up.	Closing Prices.
70,000	1	6d.	Alliance Elec. Co., Ltd. 5% Cum. Pf.	1	⅝ — ⅞
125,000	1	7½d.	Aron Elec. Meter Ltd., 6% Cum. Pf.	1	$\frac{7}{16}$ — $\frac{9}{16}$
120,000	1	9½d.	Bell's Asbestos Co., Ltd.	1	$\frac{13}{16}$ — $\frac{15}{16}$
100,000	5	4/-	British Insulated & Helsby Cables Ltd., Ord. ..	5	5¼ — 5¾
100,000	5	3/-	Do. 6% Cum. Pref.	5	5¼ — 5¾
£500,000	Stk	4½%	Do. 4½% 1st Mort. Deb. Stk. Rd.	100	102 — 105
£200,000	Stk	4½%	British Thomson-Houston Co., Ltd., 4½% 1st Mort. Deb. Stk. Red. ..	100	100 — 102
400,000	5	3/-	British Westinghouse Electric and Manufac. Co., Ltd., 6% Pref. ..	5	2⅝ — 2⅞
£616,353	Stk	4%	Do. 4% Mort. Deb Stk. Red...	100	88 — 90
105,731	2	2/-	Brush Elec. Enging. Co., Ltd., Ord..	2	⅝ — ⅞
150,000	2	2/4½	Do. 6% Pref.	2	1⅜ — 1⅝
£125,000	Stk	4½%	Do. 4½% Perp. 1st Deb. Stk...	100	93 — 96
£125,000	Stk	4½%	Do. 4½% Perp. 2nd Deb. Stk.	100	68 — 72
35,000	5	5/-	Callender's Cable & Constn. Ltd. Ord.	5	9 — 10
40,000	5	2/6	Do. 5 % Cum. Pref.	5	5 — 5¼*
£200,000	Stk	4½%	Do. 4½% 1st Mort. Deb Stk. Red.	100	104 — 106
85,000	3	1/6	Crompton & Co., Ltd...	3	1¾ — 2
£100,000		5%	Do. 5% 1st Mort. Reg. Debs.	100	94 — 99
52,000	5	10/-	Dick, Kerr & Co., Ltd., Ord. ..	5	7¼ — 7¾
61,000	5	3/-	Do. 6% Cum. Pref.	5	5½ — 5¾
£300,000	Stk	4½%	Do. 4½% Deb. Stock, Red. ..	100	107 — 109
233,334	1	6d.	Doulton & Co., Ltd., 5% Cum. Pref.	1	1⅛ — 1⅜
£233,334	Stk	4%	Do. 1st Mort. 4% Iree. Deb. Stk.	100	105 — 108
99,261	5	1/6	Edison and Swan United Electric Light, Ltd., "A" Shares Nos. 1-99,261	3	[illegible]
17,139	5	2/6	Do. "A" Shares Nos. 01-017,139	5	1 — 1½
£344,023	Stk	4%	Do. 4% Deb. Stock Red. ..	100	78 — 83
£100,000	Stk	5%	Do. 5% Second Deb. Stk. Red.	100	79 — 84
112,100	2	1/7½	Electric Construction Co., Ltd. .	2	1⅛ — 1¼
31,390	2	2/9¾	Do. 7% Cumulative Pref. ..	2	2¼ — 2½
£200,000	Stk	4%	Do. 4% Perp. 1st Mt. Deb. Stk.	100	98 — 100
10,248	10	7/6	Evered and Co., Ltd...	10	13 — 15
£100,000	Stk	5%	Ferranti, Ltd., 5% 1st Mort. Deb. Stock, Red...	100	90 — 95
25,000	10	5/-	Gen. Elect. Co. (1900), Ltd., 5% Cum. Pref.	10	9½ — 10
£200,000	Stk	4%	Do. 4% 1st. Mt. Deb. Stk., Red.	100	91 — 96
35,000	5	5/-	Henley's (W. T.) Telegraph Works Co., Ltd., Ord.	5	10¼ — 10¾
35,000	5	2/3	Do. 4½% Cum. Pref... ..	5	5 — 5½
£50,000	Stk	4½%	Do. 4½% Mt. Deb. Stk. Red.	100	110 — 112
50,000	10	5/-	India Rubber, Gutta Percha & Telegraph Works Co., Ltd.,	10	15½ — 16½
£300,000	100	4%	Do. 1st Mort. Deb. Red. ..	100	99 — 102
7,500	10		Parker, Thos., Ltd.	10	6½ — 7
37,350	12	12/-	Telegraph Construction and Maintenance Co., Ltd.	12	38 — 40
£150,000	100	4%	Do. 4% Deb. Bonds	100	103 — 105

III.—ELECTRIC TRACTION.

Present Amount Subscribed.	Shares.	Last Dividend.	Name.	Paid up.	Closing Prices.
120,000	5	3/-	Anglo-Argentine Trams Co., Ld., Or.	5	7¼ — 7½
260,007	5	2/6	Do. 5% Cum Pf.	5	5⅜ — 5⅝
£230,000	Stk	6%	Do. Permanent 6% Debenture Stock, 1888 ..	100	143 — 146
20,000	10	6/-	Barcelona Trams Co., Ltd., Ord. ..	10	10½ — 11
10,000	10	5/-	Do. 5% Cum Pf. Shares	10	9 — 10
£46,360	100	5%	Do. 5% Debs., Red. ..	100	98 — 101
£191,326	Stk	4½%	Do. 4½% Red. Deb. Stk.	100	93 — 97
75,606	1	—	Bath Elec. Trams. Ld., Pf. Or. ..	1	⅝ — ¾
59,394	1	—	Do. 5% Cum. Pf. ..	1	$\frac{15}{16}$ — $1\frac{1}{16}$
75,000	5		Brisbane Electric Tram Investment Co., Ltd., Ord... ..	5	1½ — 2
75,000	5	2/6	Do. 5% Cum. Pf. ..	5	3¾ — 4¼
£425,000	Stk	4½%	Do. 4½% 1st Deb. Stk., Red.	100	96 — 100
£200,000	Stk	6%	Brit. Columbia Elec. Rly. Co., Ltd., Def. Ord. Stock	100	100 — 103
		5%	Pref. Ord. Stock	100	100 — 103
7,500	10	5/-	Do. 5% Cum. Perp. Pf. ..	10	10¼ — 10¾
£242,800	40	4½%	Do. 4½% 1st Mort. Debs. .	40	102 — 104½
£220,000	100	4½%	Do. 4½% Vancouver Power Db.	100	98 — 101
133,301	10	6/-	Brit. Electric Traction, Ltd., Ord.	10	9¾ — 10¼
156,437	10	6/-	Do. 6% Cum. Pref... ..	10	10¾ — 11¼
£1,000,000	Stk	5%	Do. 5% Perp. Deb. Stk. ..	100	117 — 119
£250,000	Stk	4½%	Do. 4% 2nd Deb. Stk. Red..	100	95 — 97
100,000	5	1/6	Buenos Ayres & Belgrano Electric Trams, Ltd., Ord.	5	3⅝ — 3⅞
40,500	5	3/-	Do. "A" 6% Cum Pref. ..	5	5½ — 5¾
7,000	5	3/-	Do. "B" do.	5	5¼ — 5½
£200,000	Stk	5%	Buenos Ayres Elec. Trams Co. (1901), Ltd., 5% Db. Stk., Red.	100	96 — 99

ELECTRIC TRACTION.—*Contd.*

Present Amount Subscribed.	Shares.	Last Dividend.	Name.	Paid up.	Closing Prices.
£220,000	100	6%	Buenos Ayres Gd. Nat., Ltd., 6% 1st Deb. Bds.	100	97 — 100
102,268	5	3/-	Calcutta Tramways Co., Ltd. ..	5	7⅞ — 8⅛
£350,000	Stk	4½%	Do. 4½% 1st Deb. Stk., Red.	100	107 — 109
480,000	1	1/-	Cape Electric Tramways, Ltd. ..	1	$1\frac{7}{16}$ — $1\frac{9}{16}$
40,000	5	2/6	City of Birmingham Trams Co., Ltd. 5% Cum. Pref.	5	4⅞ — 5⅛
£300,000	100	4%	Do. 4% 1st Mort. Debs. ..	100	98 — 102
155,000	5	4/-	City of Buenos Ayres Trams. Co., Ld.	5	10¼ — 10½
£116,000	Stk	6%	Do. Per. 6% Deb. Stk...	100	140 — 145
£120,000	Stk	5%	Colombo Elec. Tram. & Light. Co., Ltd., 5% 1st Mort. Deb. Stk. Red.	100	101 — 104
60,000	10	6/-	Dublin United Trams. Co. (1896), Ltd., Ord. ..	10	13 — 14
59,987	10	6/-	Do. 6% Pref...	10	15 — 16
30,000	5	2/6	Isle of Thanet Elec. Trams. and Light. Co., Ltd., 5% Cum. Pref.	5	3½ — 4
£150,000	Stk	4%	Do. 4% Deb. Stock.. ..	100	90 — 93
125,000	10	5/-	London United Trams. (1901), Ltd., 5% Cum. Pref.	10	10⅝ — 10⅞
£1,031,000	Stk	4%	Do. 4% 1st Mort. Deb. Stk. Red.	100	103 — 105
£50,000	Stk	—	Madras Electric Trams (1904), Ltd., 5% Deb Stock, Red.	100	103 — 105
314,016	1	—	Metropolitan Elec. Trams, Ltd., Def.	1	⅜ — ½
500,000	1	6d.	Do. 5% Cum. Pref... ..	1	⅞ — 1
£350,000	Stk	13/7	Do. 4½% Deb. Stock, Red.	100	103 — 105
50,000	5	6/-	New General Traction Co., Ltd., 6% Cum. Pref.	5	½ — 1½
110,923	8	2/9⅗	North Metropolitan Tramways Co..	8	4 — 4½
£150,000	100	3½%	Do. 3½% Mort. Debs.	100	87 — 92
£196,200	Stk	5%	Perth Electric Trams, Ltd. (W.A.) 5% 1st Mort. Deb. Stock, Red..	100	103 — 106
24,500	10	10/-	Potteries Elec. Traction Co., Ld., Or.	10	8 — 9
24,500	10	5/-	Do. 5% Cum. Pref. ..	10	8½ — 9½
£220,000	Stk	4½%	Do. 4½% Deb. Stk., Red.	100	99 — 102

IV.—ELECTRIC LIGHTING AND POWER.

Present Amount Subscribed	Shares.	Last Dividend.	Name.	Paid up.	Closing Prices.
7,500	10	16/-	Bournemouth & Poole Elec. Sup. Co., Ltd., Ord. ..	10	12 — 13
7,500	10	4/6	Do. 4½% Cum. Pref. ..	10	9½ — 10
7,500	10	6/-	Do. 6% Cum. Second Pf. ..	10	11 — 12
£70,000	Stk	4½%	Do. 4½% Deb. Stock Red ..	100	104 — 106
14,000	5	2/-	Bromley (Kent) Elec. Lt. & Pr. Co. Ld	5	5¼ — 5¾
£50,000	Stk	4½%	Do. do. 4½% 1st Deb. Stk. Red.	100	101 — 104
27,507	5	4/6	Brompton & Kensington Elec. Supply Co., Ltd. Ord. ..	5	10½ — 11
12,493	5	3/6	Do. 7% Cum. Pref. Shares..	5	10¼ — 10¾
60,000	5	3/-	Calcutta Elec. Sup. Cor. Ltd., Ord..	5	7⅞ — 8⅛
£288,782	Stk	4%	Central Elec. Sup. Co., Ltd., 4% Gua. Deb. Stk. ..	100	104 — 107
70,000	5	4/-	Charing Cross & Strand Elec. Sup. Corp., Ltd., Ord... ..	5	8¼ — 8¾
10,000	5	—	Do. do. Ord.	5	8 — 8½
80,000	5	2/3	Do. do. 4½% Cum. Pref...	5	$5\frac{9}{16}$ — $5\frac{13}{16}$
£350,000	Stk	4%	Do. do. 4% Deb. Stk. Red.	100	101 — 103*
40,000	5	2/3	Do. do. "City Undertaking" 4½% Cum. Pref. ..	5	4⅞ — $5\frac{1}{16}$
40,000	5	2/3	Do. do. do. (1903) ..	5	4⅞ — $5\frac{1}{16}$
44,436	5	2/3	Chelsea Elec. Sply. Co., Ltd., Ord.	5	6¼ — 6¾
£150,000	Stk	4½%	Do. do. 4½% Deb. Stk., Red	100	109 — 111
70,595	10	5/-	City of London El. Lghtg. Co., Ld., O.	10	10¾ — 11¼
40,000	10	6/-	Do. 6% Cum. Pref.	10	13½ — 14
£400,000	Stk	5%	Do. 5% Deb. Stk., Red ..	100	123 — 127
£300,000	Stk	4½%	Do. 4½% 2nd Deb. Stk., Red	100	103 — 105
40,000	10	4/-	County of London Elec. Supply Co., Ltd., Ord.	10	9 — 9½
30,000	10	6/-	Do. 6% Cum. Pref.	10	12 — 12½
£400,000	Stk	4½%	Do. 4½% Deb. Stk., Red. ..	100	107 — 110
£250,000	—	4½%	Do. 4½% 2nd Deb. Stk., Prv. Crts. all paid, Red	100	101 — 103
70,000	5	4/6	Edmundson's Elec. Cor. Ltd., Ord.	5	6⅛ — 6⅜
70,000	5	3/-	Do. 6% Cum. Pref.	5	6 — 6¼
£300,000	Stk	4½%	Do. 4½% 1st Mort. Db. Stk. Reg	100	107 — 109
£80,000	Stk	5%	Electric Lighting & Traction Co. of Australia, Ltd. 5% Deb. Stk. Red.	100	88 — 93
10,000	5	2/-	Folkestone Elec. Supply Co., Ld., O.	5	5½ — 6
£50,000	Stk.	4½%	Do. 4½% 1st Deb. Stk., Red.	100	102 — 105
15,000	10		Havana Electricity Co., Ltd... ..	10	9½ — 10½
13,000	5	3/6	Hove Elec. Lighting Co., Ltd., Ord.	5	7½ — 8
£50,000	Stk	4½%	Isle of Wight Electric Light & Power Co., Ltd. 4½% Deb. Stock, Red.	100	100 — 102
150,000	1	-	Kalgoorlie Electric Power & Lighting Corp, Ltd., 6% Cum. Pref.	1	$\frac{9}{16}$ — $\frac{11}{16}$
21,000	5	5/-	Kensington and Knightsbridge Electric Lighting Co., Ltd., Ord. ..	5	12½ — 13

Stocks and Shares marked * are quoted ex-dividend.

ELECTRIC LIGHTING AND POWER.—*Contd.*

Present Amount Subscribed.	Shares.	Last Dividend	Name.	Paid up.	Closing Prices.
£135,000	Stk	4%	Kensington and Knightsbridge Electric Lighting Co., Ltd., and the Notting Hill Electric Lighting Co., Ltd., 4% Deb. Stock, Red.	100	102 —104
111,000	3		London Elec. Supply Corp., Ld., Ord.	3	2 — 2¼
60,000	5	3/-	Do. 6% Pref.	5	5⅝ — 5⅞
£371,895	Stk	4%	Do. 4% 1st Mort. Db. Stk., Red	100	95 — 97
100,000	10	9/-	Metropolitan Elec. Sup. Co., Ld., Or.	10	16¼ — 17¼
76,121	5	2/3	Do. 4½% Cum. Pref.	5	5 7/16 — 5 9/16
220,000	Stk	4½%	Do. 4½% 1st Mort. Db. Sk., Red.	100	112 —117
250,000	Stk	3½%	Do. 3½% Mort. Deb. Stk., Red.	100	97 — 99
£250,000	-	4½%	Midland Elec. Corp. for Power Distribution, Ld., 4½% 1st Mort. Deb.	100	93 — 96
10,852	10	6/-	Notting Hill Elec. Ltg. Co. Ltd. Ord.	10	14½ — 15
£59,000	100	4%	Do. 4% 1st Mort. Debs. ..	100	101 —103
16,500	5	2/6	Oxford Electric Co. Ltd., Ord. ..	5	6½ — 6¾
£50,000	Stk	4%	Do. 4% Debenture Stk. Red.	100	99 —101
£84,700	100	4½%	Royal Elec. Co. (of Montreal) 4½% 20-yr. 1st Mort. Deb	100	100 —102
40,000	5	5/-	St. James' & Pall Mall Elec. Light Co., Ltd. Ord.	5	13¾ — 14¼
20,000	5	3/6	Do. 7% Pref...	5	8½ — 9
£150,000	Stk	3½%	Do. 3½% Deben. Stock, Red	100	99 —101
12,000	5	4/-	Smithfield Markets Elec. Supply Co., Ltd. Ord.	5	2¾ — 3¼
£50,000	Stk	4%	Do. 4% Debenture Stk Red.	100	83 — 87
65,000	5	3/-	South London Elec. Sup. Co., Ltd. O.	5	4⅛ — 4⅜
100,000	1		South Metropolitan Elec Light & Power Co., Ltd. Ord.	1	13/16 — 15/16
50,000	1	8½d.	Do. 7% Cum. Pref.	1	1 5/16 — 1 7/16
£100,000	Stk	4½%	Do. 4½% 1st Deb. Stock Red.	100	107 —110
50,000	5	2/6	Urban Electric Supply Co., Ltd., O.	5	4 15/16 — 5 1/16
30,000	5	2/6	Do. 5% Cum Pref.	5	5 — 5⅛
£200,000	Stk		Do. 4½% 1st Mort. Deb. Stk. Red	100	104 —106
110,000	5	6/6	Westminster Elec. Supply Corp. Ltd., Ord.	5	12¾ — 13¼
28,151	5	2/6	Do. 5% Cum. Pref.	5	6¼ — 6¾

V.—TELEGRAPH & TELEPHONE COMPANIES.

Present Amount Subscribed.	Shares.	Last Dividend.	Name.	Paid up.	Closing Prices.
£34,800	100	4%	African Direct Tel. Co., Ld., 4% Mt. Debs. (Series A), Red.	100	100 —103
25,000	10		Amazon Telegraph Co., Ld... ..	10	1 — 1½
£763,580	Stk	12/6	Anglo-American Tel. Co., Ltd., Ord.	100	55 — 57
£3,118,210	Stk	25/-	Do. 6% Preferred Ordinary	100	103½ — 104½
£3,118,210	Stk	2/-	Do. Deferred Ordinary ..	100	12⅛ — 12⅜
44,000	5	4/-	Chili Telephone Co., Ltd.	5	5¾ — 6
$15,000,000	$100	$2	Commercial Cable Co., Capital Stk.	$100	170 —190
£1,903,856	Stk	4%	Do. Sterl. 500-yr 4% Deb. Stk., Red.	100	93 — 96
16,000	10	5/-	Cuba Submarine Tel. Co., Ld., Ord.	10	8¾ — 9¼
6,000	10	10/-	Do. 10% Preference	10	16½ — 17½
6,000	5	2/-	Direct Spanish Telegraph Co., Ord.	5	3⅜ — 3⅝
		5/-	10% Cum. Preference	5	7¾ — 8¼
£30,000	50	4½%	Do. 4½% Debs...	50	102—104%
60,710	20	3/-	Direct U.S. Cable Co., Ltd... ..	20	10¾ — 11
£85,800	100	4½%	Direct West India Cable Co., Ltd., 4½% Reg. Debs.	100	101 —103
£300,000	100	4%	East. & S. African, Ld., 4% Mt. Dbs.	100	101 —103
£200,000	25	4%	Do. 4% Rg. Mt. Dbs. (Mauritius Subsidy)..	25	100-102%
300,000	10	2/6	Eastern Extension, Australasia and China, Ltd...	10	13½ — 14
£602,400	Stk	4%	Do. 4% Mort. Deb. Stk., Perp.	100	106 — 108
£4,000,000	Stk	25/-	Eastern Tele. Co., Ltd., Ord. ..	100	135 — 138
£2,000,000	Stk	17/6	Do. 3% Pref.	100	88 — 90
£1,836,814	Stk	4%	Do. 4% Mort. Deb.	100	105 —107
150,000	10	5/-	Great Northern Telegraph Co., Ltd., (of Copenhagen) ..	10	28¾ — 29¼
£58,700	100	4½%	Halifax and Bermudas Cable Co., Ltd., 4½% 1st. Mort. Debs. Red.	100	101 —103
17,000	25	12/6	Indo-European Tele. Co., Ltd. ..	25	44½ — 46½
72,680	1	7½d.	Monte Video Telephone Co., Ltd., O.	1	[illegible]
£1,983,333	Stk	6%	National Telephone Co., Ltd., Pref.	100	108½ — 109½
£1,966,667	Stk	5%	Do. Deferred	100	101—102
15,000	10	6/-	Do. 6% Cum. 1st Pref. ..	10	13 — 15
15,000	10	6/-	Do. do. 2nd do. ..	10	12 — 13
250,000	5	2/6	Do. 5% Non-Cum. 3rd Pref.	5	5¼ — 5¾
£2,000,000	Stk	3½%	Do. 3½% Deb. Stk., Red. ..	100	98 — 99
£689,59[illegible]	Stk	4%	Do. 4% do. do. ..	100	103½ — 105½
£1,000,000	—	5/9	Do. 4% Prov. Certs. 35% to be paid..	–	67½ — 68½
179,313	1	7½d.	Oriental Telephone & Elec. Co., Ltd.	1	1 — 1⅛
£50,000	1	7½d.	Do. 6% Cum. Pref.	1	1⅛ — 1¼
£100,000	100	4%	Pacific & European Tel. 4% Guar. Debs. Red...	100	98 —100
11,839	8	4/-	Reuter's Telegram Co., Ltd. ..	8	7 — 7½
58,000	5	5/-	United River Plate Telep. Co., Ltd.	5	6⅝ — 6⅞
40,000	5	2/6	Do. 5% Cum. Pref.	5	5⅛ — 5⅜
£179,947	Stk	5%	Do. 5% Deb. Stock, Red. ..	100	105½ —107½
15,609	10	4/-	W. African Telegraph Co., Ltd. ..	10	7¼ — 7¾

TELEGRAPHS AND TELEPHONES.—*Contd.*

Present Amount Subscribed.	Shares.	Last Dividend.	Name.	Paid up	Closing Prices.
£30,008	2½	—	West Coast of America, Ltd. ..	2½	½ — [illegible]
150,000	100	4%	Do. 4% Deb. Guar. by West. Tel.	100	98 —100
88,321	10	6d.	W. India & Panama Teleg. Co., Ld., Or.	10	[illegible]
34,563	10	6/-	Do. 6% Cum. 1st Pref. ..	10	7½ — 7¾
4,669	10	6/-	Do. 6% Cum. 2nd Pref. ..	10	6¾ — 7¼
£80,000	100	5%	Do. 5% Deb.	100	103½ —105½
207,930	10	3/-	Western Telegraph Co., Ltd.	10	13½ — 14
£75,000	100	5%	Do. 5% Debs., 2nd Series, 1956	100	103 —105
518,915	Stk	4%	Do. 4% Deb. Stock, Red.	100	101½ — 103½

VI.—SHIPPING COMPANIES.

Present Amount Subscribed.	Shares	Last Dividend.	Name	Paid up	Closing Prices.
32,500	10	5/6	Anchor Line (Henderson Bros.), Ltd., 5½% Cum. Pref.	10	8¼ — 8¾
£325,000	Stk	4½%	Do. 4½% Red. 1st Mort. Deb. Stk.	100	98 —100
£672,900	Stk	4½%	British & African Stm. Nav. (1900) Ltd., 4½% 1st Mort. Deb. Stk. Red.	100	93 — 95
40,000	10	5/6	Bucknall Steamship Lines, Ltd., 5½% Cum. Pref.	10	6 — 7
£600,000	Stk	4½%	Do. 4½% 1st Mort. Deb. Stk.	100	75 — 78
£750,000	Stk	4½%	Clan Line Steamers, Ltd., 4½% Deb. Stk. Red. ..	100	100—102
60,000	20	16/-	Cunard Steam Ship Co., Ltd., Nos. 1-60,000..	20	13 — 13½
40,000	20	8/-	Do. Nos. 60,001-100,000	10	5¾ — 6¼
£464,430	Stk	4½%	Elder Dempster Shipping, Ltd., 4½ 1st Mort. Deb. Stk. ..	100	99 —101
1,200,000	1	6d.	Furness, Withy & Co., Ltd., Ord...	1	1 — 1⅛
30,000	10	5/-	Do. 5% Cum. Pref.	10	9¾ — 10¼
327,300	100	4½%	Do. 4½% 1st Mort. Debs. Red.	100	105 —107
25,328	7½	4/7	Gen. Steam Navigation Co., Ld., Ord.	7½	4¼ — 4¾
36,758	8	4/9	Do. Non-Cum. 6% Pref... ..	8	7¼ — 7¾
£150,000	Stk	4%	Do. 4% 1st Mort. Deb. Stk. Red.	100	97 — 99
55,000	5	1/3	Houlder Line, Ltd., Ord.	5	3 — 3½
40,000	5	2/9	Do. 5½% Cum. Pref. ..	5	3¼ — 3¾
£200,000	Stk	4½%	Do. 4½% 1st Mt. Deb. Stk. Red.	100	85 — 88
141,500	10	5/-	Leyland (Fredk.), & Co. (1900), Ltd., 5% Cum. Pref.	10	5 — 5½
£1,160,000	Stk	5%	Peninsular and Oriental Steam Nav. Co., 5% Cum. Pref. ..	100	126 —129
£1,160,000	Stk	19%	Do. do. Deferred ..	100	214 —217*
£800,000	Stk	3½%	Do. do. 3½% Deb. Stock..	100	99 —101
£648,100	Stk	3½%	Do. do. 3½% 2nd Deb. Stk.	100	96 — 98
15,000	100	30/-	Royal Mail Steam Packet Co. Ord..	60	21½ — 22½
39,075	5	2/6	Shaw, Savill & Albion, Ltd., 5% Cum. "A" Pref..	5	4¾ — 5¼
39,075	5	2/6	Do. "B" Ord...	5	4 — 4½
141,841	10	4/-	Union Castle Mail Steamship Co., Ltd., Ord..	10	8 — 8½
24,000	10	4/6	Do. 4½% Cum. Pref... ..	10	9¾ — 10¼
£1,008,894	Stk	4%	Do. 4% Debenture Stk., Red.	100	100 — 102

VII.—MISCELLANEOUS COMPANIES.

Present Amount Subscribed.	Shares.	Last Dividend.	Name.	Paid up.	Closing Prices.
60,000	1	9½d.	Chadburn's (Ship) Tele. Ltd., Ord...	1	⅞ — 1⅛
£750,000	Stk	5%	General Hydraulic Power Co., Ltd.	100	135 —140
12,500	10	10/-	Oakey (John) and Sons, Ltd., Ord..	10	24 — 26
10,000	10	6/-	Do. do. 6% Cum. Pf.	10	14 — 15
183,538	1	6·3d.	Power Gas Corp., Ltd., Ord., Nos. 66,463-250	15/-	[illegible]
66,462	1	8·4d.	Do. do. Nos. 1-66,462	1	[illegible]
135,000	1	6d.	Waygood (R.) & Co., Ltd., Ord. ..	1	1⅛ — 1¼
135,000	1	7½d.	Do. 6% Cum. Pref. ...	1	1⅛ — 1¼

RAILWAY CARRIAGE & WAGON COMPANIES.

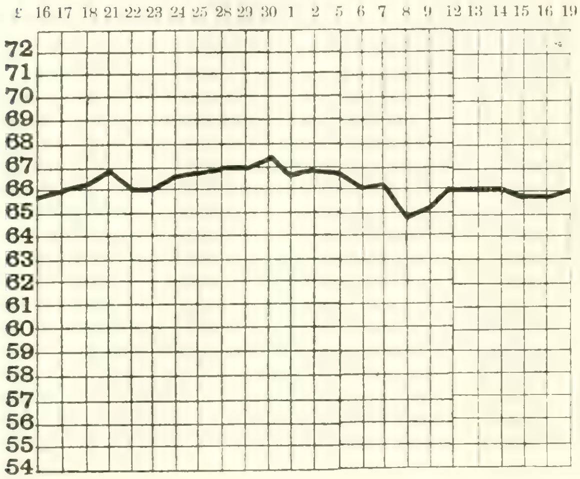
Present Amount Subscribed.	Shares.	Last Dividend	Name	Paid up	Closing Prices
10,000	10	7/6	Birm. Railway-Car. & Wagon, L., 1-10,000	10	21 — 21½
8,739	10	3/-	Do. Second Issue 1-8,739 ...	4	8 — 8½
10,000	10	6/-	Do. Cum. Pref. 6% 1-10,000..	10	13 — 13½
30,111	7	7/-	Gloucester Rail.-Car & Wagon, Ld., A, 1-29,861 & 49,751-50,000	7	8½ — 8¾
44,889	7	3/6	Do. B, 29,862-49,750, 50,001-75,000	7	4 — 4¼
784,808	1	9d.	Metropolitan Amalgamated Rail.-Carriage & Wagon, Ld., 1-784,808	1	38/- — 39/-
164,288	1	6d.	Do. Cum. A Pref. 5% 1-164,288	1	23/3 — 24/3
235,000	1	7½d.	Do. Cum. B Pref. 6% 1-235,000	1	27/6 — 28/6
20,000	20	20/-	Midland Rail.-Car. & Wagon, Ld., 1-20,000	10	18¾ — 19¼
10,000	20	7½d.	Do. Pref. 6 per cent. 1-10,000		21/0 — 23/0

Stocks and Shares marked * are quoted ex-dividend.

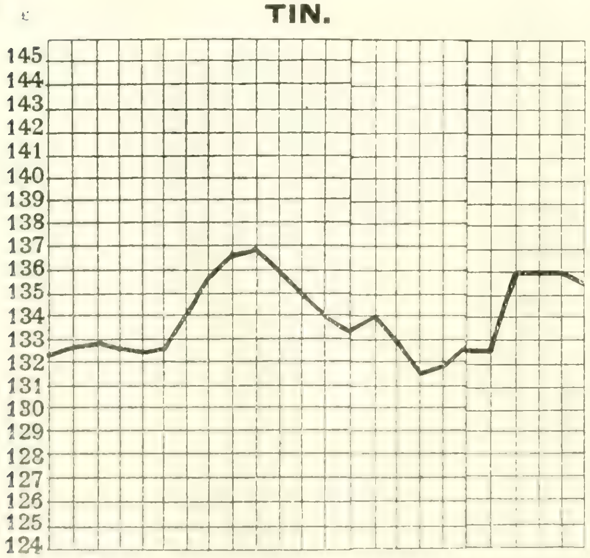
THE HOME METAL MARKET.

SHOWING DAILY FLUCTUATIONS FROM NOVEMBER 16TH TO DECEMBER 19TH, 1904.

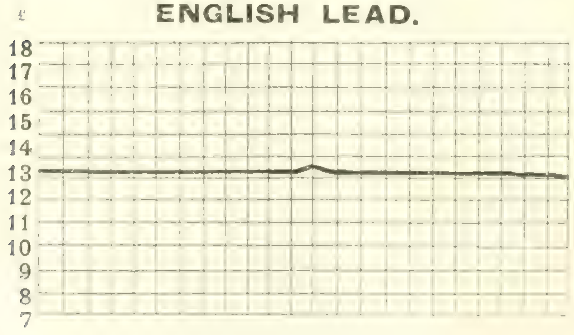
COPPER.



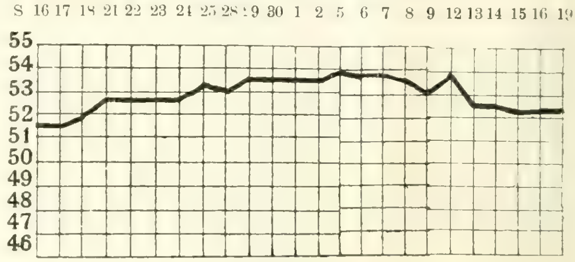
TIN.



ENGLISH LEAD.



PIG IRON: SCOTCH,



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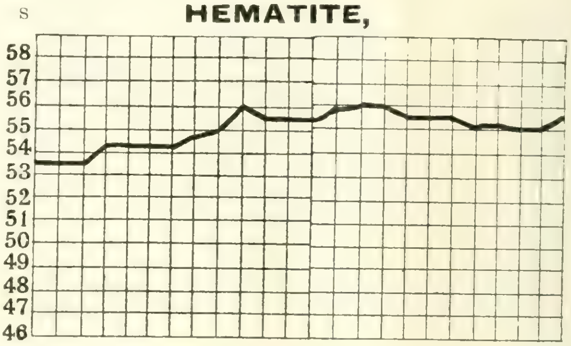
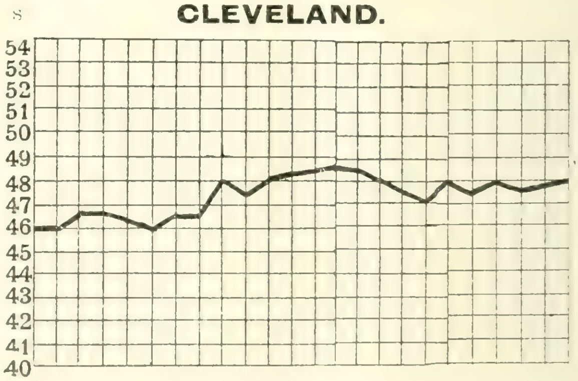
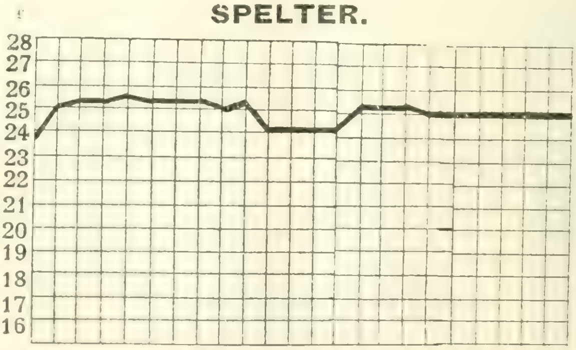


CLEVELAND.



SPELTER.



PRICES CURRENT OF COAL, IRON, STEEL, AND OTHER METALS.

MANUFACTURERS' AND MERCHANTS' QUOTATIONS.

MARKET REPORT.

Wednesday, December 21st, 1904.

THE copper market has to some extent shaken itself free from what is happening in the share market, and the renewed attacks upon Amalgamateds have had little influence in affecting the price of the metal. Messrs. Henry R. Merton and Co.'s statistics give the visible supply as 16,173 tons, as compared with 16,044 tons at the end of November. The total supplies for the fortnight were 16,664 tons, and the deliveries 18,535 tons, while stocks in England and France stand at 8,898 tons, against 9,344 tons a fortnight ago. Chili charters for the fortnight were 1,500 tons. Although the market is not likely to show much activity during the holidays, consumption is on so large a scale that it is difficult to resist the conclusion that higher prices for the metal will be witnessed in the near future.

The feature in tin has been the scarcity of warrants for prompt delivery, and the market is in the grip of bull operators. The result has been a sharp distinction between the prices for spot tin and forward metal. At the moment of writing the quotation is more normal in this respect. The backwardation exacted by the corner was about £5 per ton. The actual position of the metal is sound and the outlook makes for a steadier market. The price is £131 15s. cash and £130 three months.

The iron and steel market has firmed up in response to strong advices from America. Trade reports are satisfactory, and the expectations of improving trade in the New Year which are generally held appear to be based on accurate views. It is to be noted that the position, so unlike that of tin and copper is, outside the warrant section, fairly free from speculative complications.

Spelter has been steadier, there having been some repurchasing on the part of the bears. Producers are asking prices well above London parity, and a sharp rise in quotations appear to be imminent.

Lead has been inclined to droop, and is easier at foreign £12 15s., English £13.

Coal is a quiet market, brights and cobbles being in chief demand.

The Metal Exchange will be closed after first change on Friday, December 23rd., until Tuesday morning, December 27th, and after first change on Friday, December 30th, until Tuesday morning, January 3rd, 1905.

IRON, STEEL, PIG-IRON, &c.

SCOTLAND.

Messrs. David Colville and Sons, Ltd., Dalzell Steel and Iron Works, Motherwell, N.B., quote as follows. Prices delivered in Glasgow or equal :—

	£	s.	d.
Steel :			
Siemens' Steel Plates, Marine Boiler Quality	6	15	0
,, ,, ,, Land ,, ,,	6	17	6
,, ,, ,, Ship Quality Plates	5	15	0
Siemens' Steel Bars, Boiler Quality	6	15	0
,, ,, ,, Ship ,,	6	5	0
,, ,, Angles	5	5	0
Manufactured Iron :			
Bars—Dalzell	6	2	6
,, Best	6	12	6
,, ,, Horseshoe	6	12	6
,, Angle	6	2	6
,, Best Angle	6	12	6
,, Best Best	7	2	6
,, Extra Best	7	12	6

Usual terms and extras. Special rates for delivery in England and export. The above prices subject to alteration without notice.

The Glasgow Iron and Steel Co., Ltd., Wishaw, quote as under (prices are delivered Glasgow or equal) :—

	£	s.	d.	
Steel Angles (Glasgow ♔ Steel)	5	5	0	per ton.
Steel Ship Plates (Glasgow ♔ Steel)	5	15	0	,,
Steel Bars, Ship Quality (Glasgow ♔ Steel)	6	5	0	,,
Steel Bars, Boiler Quality (Glasgow ♛ ♛ Steel)	6	15	0	,,
Steel Land Boiler Plates (Glasgow ♛ ♛ Steel)	6	5	0	,,
Steel Marine Boiler Plates (Glasgow ♛ ♛ Steel)	6	5	0	,,

Less 5 per cent. discount. Extras as per standard list.

Special prices for delivery in England and for export. The above prices subject to alteration without notice.

John Spencer (Coatbridge), Ltd., Phœnix Ironworks, Coatbridge, N.B., quotes :—

	£	s.	d.
Bars—Phœnix	6	5	0
,, Best	6	15	0
,, Best Best	7	5	0
,, Extra Best	7	15	0
,, Best Horse Shoe	6	15	0
,, Extra B.H.S.	7	15	0
,, Extra Best Cable	8	5	0
,, Rivet	6	5	0
,, Best Scrap Rivet	7	5	0

	£	s.	d.
Angles—Phœnix	6	5	0
,, Best	6	15	0
,, Extra Best	7	5	0
Gas Tube Hoops—Phœnix Best	6	15	0
Plates—Phœnix	–	–	
,, Best Boiler	7	10	0
,, Best Best Boiler	8	0	0
,, Extra Best Boiler	9	0	0
Boiler Tube Strips—Phœnix Best Best	8	0	0

All per ton, delivered f.a.s., Glasgow, Greenock, Grangemouth, Granton, Leith, or Ardrossan. 5 per cent. discount cash monthly.

Messrs. R. Feldtmann and Co., of Glasgow, quote (Commission extra).

Pig Iron:	No. 1.			No. 3.		
	£	s.	d.	£	s.	d.
Coltness, f.a.s. Glasgow	3	4	0	2	14	6
Gartsherrie ,,	2	18	6	2	14	0
Summerlee ,,	2	18	6	2	13	6
Carnbroe ,,	2	15	0	2	12	0
Langloan ,,	3	4	0	2	14	0
Calder ,,	2	18	6	2	13	6
Clyde ,,	2	18	0	2	13	6
Glengarnock, f.o.b. Ardrossan	2	18	0	2	12	6
Eglinton ,, ,,	2	13	6	2	11	0
Dalmellington, ,, Ayr	2	14	0	2	11	0
Shotts ,, Leith	2	18	6	2	13	6

NORTH OF ENGLAND.

Messrs. W. Whitwell and Co., Ltd., Thornaby Ironworks, Stockton, quote as follows, **at works:—**

	£	s.	d.
W.W. ♔ Bars	6	7	6
W.W. Best Bars	6	17	6
W.W. Best Best	7	7	6
W.W. Best Best Best	7	17	6
W.W. Best Shoe	6	17	6
Thornaby ♔	7	17	6
Thornaby Best	8	7	6
Thornaby Best Best	9	7	6
Whitwell Special Admiralty Cable	10	0	0
Special Chain Iron	9	0	0
Tube and Nail Strips	6	10	0
W.W. ♔ Angle Iron	6	10	0
W.W. Best Angle Iron	7	0	0
Tee Iron, to 8-inches United	7	7	6

Terms, Cash, less 2½ per cent. discount on 10th of month ollowing delivery.

LANCASHIRE.

The Pearson and Knowles Coal and Iron Company, Ltd. Dallam and Bewsey Forges, Warrington, quote:—

	Iron.			Steel.		
	£	s.	d.	£	s.	d.
Crown (BNF) Bars	6	10	0	7	0	0
,, ,, Angles	7	0	0	7	10	0
,, ,, Tees	7	10	0	8	0	0
,, (WIW) Hoops	7	0	0	7	10	0
,, ,, Sheets	7	10	0	8	0	0

Ordinary Sizes, F.A.S. Liverpool in 10-ton Lots.
Extras for Sizes and Cutting as per List.

WORCESTERSHIRE.

Baldwins Ltd. (with which is amalgamated Knight and Crowther, Ltd.), Wilden Works, near Stourport, quote:—

	Singles 20 G 96in. by 36in. per ton.			Doubles 21 G to 24 G 96in. by 36in. per ton.		
Black Sheets:	£	s.	d.	£	s.	d.
"Vale"	10	0	0	10	10	0
"Shield"	10	10	0	11	10	0
"Severn"	11	10	0	12	10	0
"Baldwin Wilden B."	12	10	0	13	10	0
Charcoal	16	10	0	17	10	0
Best Charcoal	18	10	0	19	10	0

Pickled, cold-rolled and close annealed sheets specially quoted for.

Extra widths, Singles to 66in., Doubles to 56in., Lattens to 46in. Extra lengths, Singles to 168in., Doubles to 132in., Lattens to 108in.

Patent Coated Sheets:						
	£	s.	d.	£	s.	d.
No. 3 Lead	13	10	0	14	10	0
S.V. Lead	15	0	0	16	0	0
No. 3 Terne	15	0	0	16	0	0
S.V. Terne	16	10	0	17	10	0

	Singles 20 G to 108 by 36in. per ton.			Doubles 21 to 24 G to 96 by 36in per ton.		
Tinned Sheets:	£	s.	d.	£	s.	d.
Best Coke (Finish)	28	0	0	29	10	0
,, Charcoal (Finish)	30	0	0	31	10	0
Extra ,, ,,	32	0	0	33	10	0

Cotton Can Tin Sheets to 39in. by 36in. specially quoted for.

Tin Plates, "Cookley, K" Best Charcoal, £1 7s. 0d. per box.

Extreme sizes in Tin and Patent Coated specially quoted for.

Lattens up to 36 wide by 27 W.G. £1 10s. 0d. per ton extra throughout for all brands.

At works less 2½% for cash monthly, 10th inst.

Galvanized Corrugated Sheets:

	£	s.	d.	
"Phœnix" Brand, 24 G., f.o.b. London, in Bundles	11	10	0	per ton.
"Blackwall" Brand, 26 G., in felt-lined cases for Australia, f.o.b. London	14	5	0	,,

Galvanized Working Up-Sheets:

	£	s.	d.	
24 G., f.o.b. London, in Bundles	13	10	0	per ton.

STAFFORDSHIRE.

Shelton Iron, Steel, and Coal Co., Ltd., Stoke-on-on-Trent, North Staffordshire, and 122, Cannon Street, London, quote:—

	£	s.	d.	
Crown Bars	6	10	0	per ton.
Best Bars (1 to 6in. wide, above ¼ in. thick, ½ in. to 4 rounds and squares)	7	0	0	,,
Angles	6	15	0	,,
,, Best	7	5	0	,,
T's	7	0	0	,,
,, Best	7	10	0	,,
Best Shoe Iron	8	0	0	,,
,, Rivet Iron	8	0	0	,,
,, Best Rivet (Special)	9	5	0	,,
,, Cable	9	5	0	,,
,, Screwing	8	5	0	,,

	£	s.	d.	
Best Turning	8	0	0	per ton.
,, Plating	8	5	0	,,
,, ,, Best Best	9	5	0	,,
,, ,, Treble	10	5	0	,,

Channels to 5 by 2¾ in. from 7⅛ to 9¼ in. wide from 10 to 12 in. wide; according to specification.

Girders, 5½ by 2 in.

,, from 8¼ by 3 to 9 by 5 in., and 3 by 4.

,, 10, 10½, and 12 in. high, according to specification.

	£	s.	d.	
Plates	7	10	0	per ton.
Best Plates	8	0	0	,,
,, Boiler Plates	8	10	0	,,
,, Best Boiler Plates	9	10	0	,,
Treble Best Boiler Plates	12	0	0	,,

WALES.

Cordes (Dos Works), Ltd., of Newport, Mon., quote "Star" brand patent wrought nails, steel nails, &c.

Discounts—

45 per cent. off 1-inch to 3-inch strong rose and all fine rose and 6dy. and 8dy. pound.

40 per cent. off 3½-inch to 7-inch strong rose and 10dy. and 20dy. pound.

40 per cent. off all sharp-pointed nails.

Delivered in lots of 2 cwt. and upwards. Extra 2½ per cent. discount off the gross on two tons and upwards.

Steel rose, flat points, 5-inch to 7-inch basis:—

2 tons 9/3 per cwt.
Under 2 tons 9/6 per cwt. } d/d any Railway Station.

Steel cut nails, 3-inch basis—

2 tons 8/- per cwt.
Under 2 tons 8/3 per cwt. } d/d any Railway Station.

Slit rods (iron) £7 10s. per ton, at works for 2-ton lots.

Messrs. Richard Thomas and Co., Ltd., of 3, Love Lane, Eastcheap, E. C. — Works: South Wales, Burry, Lydney, Lydbrook, and Cwmbwrla, quote:

	Per Box. f.o.b. Wales. £	s.	d.
Coke Tin-plates.			
C 18¾ by 14 124s. 110 lb. "BV"	0	13	0
C 20 by 10 225s. 155 ,, "Jumbo"	0	18	3
C 20 by 14 112s. 108 ,, "Lydbrook"	0	12	6
C 28 by 20 112s. 216 ,, "Lydbrook"	1	5	3
Charcoal Tinplates:			
C 20 by 14 112s. 108 lb. "Allaway"	0	13	3

BELGIUM.

C. L. Faulkner, Suffolk House, Laurence Pountney Hill, London, E.C., quotes:—

Prices quoted are in £ stg. and per ton of 1,015 kos. (2,240 lb.) delivered free on board ANTWERP for approved quantities.

		£	s.	d	
Steel:					
Blooms	at	3	12	0	per ton.
Billets	at	3	14	0	,,
Sheet Bars	at	3	16	0	,,
Finished Steel:					
Bars	at	4	15	0	per ton.
Angles	at	4	16	0	,,
Tees	at	4	19	0	,,
Joists	at	4	7	6	,,
Fencing Standards	at	4	19	0	,,
Shoeing Bars	at	5	2	0	,,
Tyre Bars	at	5	4	0	,,
Half-Round Bars	at	5	5	0	,,
Heavy Rails	at	4	10	0	,,
Light Rails	at	4	16	0	,,

METALS.

Messrs. French and Smith, 147, Leadenhall Street, and 11, Oldhall Street, Liverpool, quote:—

TIN.

Tin:	£	s.	d.		£	s.	d.	
English f.o.b. Ingots... Dis. 1¼%	132	10	0	to	133	0	0	per ton.
London or Liverpool Bars —4 cwt. Barrels...... Dis. 1¼%	133	10	0	to	134	0	0	,,
Straits Warehouse net cash	131	10	0	to	132	0	0	,,
London 3 months fixed	129	10	0	to	129	15	0	,,
Warehouse, London:								
Australian net cash	131	10	0	to	132	0	0	,,
Banca ,, ,,	131	10	0	to	132	0	0	,,
Billiton ,, ,,	132	0	0	to	132	10	0	,,

COPPER.

Copper:	£	s.	d.		£	s.	d.	
Ore	0	11	9	to	0	12	9	per unit.
Regulus, Matte and Precipitate	0	13	0	to	0	13	6	,,
Chili Bars G.M.B. Cash 2½%	65	17	6	to	66	0	0	per ton
Swansea, Liverpool, or London 3 months fixed	66	5	0	to	66	7	6	,,
Australian in Warehouse. London, P. C. C. Burra Cake, Wallaroo Cake......					Nominal.			
Other Brands 2½%	67	5	0	to	68	5	0	,,
English f.o.b.								
Tough Cake 2½%	68	15	0	to	69	5	0	,,
,, Ingot	68	15	0	to	69	5	0	,,
Best Selected 2½%	69	5	0	to	69	15	0	,,
Sheets, Sheathing and Rods 2½%	79	0	0	to	79	10	0	,,
Sheets, 4 by 4 feet for India 2½%	76	0	0	to	77	0	0	,,
Electro, Net	69	10	0	to	70	0	0	,,

YELLOW METAL.

Yellow Metal:	£	s.	d.	£	s.	d.	
Sheets, 4 by 4 feet for India 2½%	0	0	6¾	—	—		lb
f.o.b. Sheathing 2½%	0	0	6¾	—	—		,,

SPELTER.

	£	s.	d.		£	s.	d.	
Silesian, Net cash at outports	25	0	0	to	25	10	0	per ton
Special Silesian, at outports	25	10	0	to	26	0	0	,,
British, Net cash at London	25	0	0	to	26	0	0	,,
Blende of 50%	7	0	0					,,
Calamine	7	2	6					,,

LEAD.

	£	s.	d.		£	s.	d.	
English Pig, 2½%, at works, London, Liverpool or Swansea	12	17	6	to	13	0	0	per ton
Spanish, 2½%, ex ship. Bristol, Liverpool, Newcastle, Swansea, etc.	12	15	0	to	12	17	6	,,
Lead Ore of 70%	6	11	0	to	6	15	0	,,

ANTIMONY.

	£	s.	d.		£	s.	d.	
Star Regulus	37	10	0	to	38	0	0	per ton
Ore (50%, good quality and produce)	8	10	0	to	9	0	0	,,
Crude	14	0	0	to	14	10	0	,,

QUICKSILVER.

	£	s.
Spanish per flask containing 75 lb	7	15
Italian ,, ,, ,, ,,	7	14

COAL.

LEICESTERSHIRE.

The Nailstone Colliery Company, Leicester, quote. Price per Ton at Pit of 20 Cwt., with ½ Cwt. per Ton for wastage:—

Upper Main Seam.	s.	d.
Main Coal	8	0
Best Hard Steam (hand picked, as used by the Railway Companies)	7	0
Best Hard Steam Cobbles (made through 6 in. mesh, free from slack)	6	6
Fine Slack	0	6

Terms, net cash on 10th of month following delivery.

DERBYSHIRE.

The Manners Colliery Co., Ltd., of Ilkeston quote as follows, per ton at pit:

Kilburn Coal:	s.	d.
Best London Brights	9	9
Large Nuts (1½ to 3¼)	9	6
Small Nuts (¾ to 1½)	6	0
Rough Brights	6	0
Peas (¼ to ¾)	5	0
Slack	3	6
Smudge	2	0

Low Main (or Tupton) Coal:		
Low Main Brights	7	6
,, ,, Nuts	7	3
Hards (Good Steam Coal)	8	0
Bakers' Nuts (1″ to 2″)	6	6
Slack	3	6

The Clay Cross Company's Collieries, Clay Cross, near Chesterfield, quote:—

	per ton at pit. s.	d.
Best Main Coal	10	6
Best Silkstone	10	0
Best Selected Tupton Brights	9	0
Best Treble Screened Cobbles	7	9
Best Cobbles	7	3
Best Picked Hards	8	3

NOTTINGHAMSHIRE.

The Digby Colliery Co., Ltd., near Nottingham, quote per ton at pit:—

Digby Coal:

Steam.	s.	d.
Best Hand Picked Hard	9	0
Steam Hard	7	9
Hard Nuts	7	0

Gedling Colliery.

High Hazel.		
London Brights, 4 to 8 in. cube	12	0
Large Nuts, 2 to 4 in. cube	9	6
Small Nuts, ¾ to 2 in. cube	5	6

Steam.—Top Hard.		
Best Hard	9	0
Hard Steam	8	0
Cobbles	7	0

CHEMICALS AND OILS.

CHEMICALS.

Messrs. S. W. Royse and Co., Albert Square, Manchester, quote:

	£	s.	d.	
Acids: Oxalic	0	0	2½	per lb.
Picric, Crystals	0	0	11	,,
Tartaric .... at Manchester	0	0	11	,,

	£	s.	d.	
Acetate of Lime: Brown at Manchester net	8	10	0	per ton.
Grey ,,	11	0	0	,,
Alumina: Alum, Lump, loose	5	5	0	,,
,, ,, in casks	5	7	6	,,
,, Ground, in bags	5	15	0	,,
Sulphate of Alumina, 14%	4	10	0	,,
Ammonia: Carbonate	0	0	3⅝	per lb.
Muriate Grey f.o.b. Liverpool	23	10	0	per ton.
Sal-ammoniac, Lump, 1sts, del$^{d.}$ U.K.	42	0	0	,,
,, ,, 2nds, ,,	40	0	0	,,
Sulphate .... f.o.b. Liverpool	12	17	6	,,
Arsenic: Best White Powdered ....net	12	5	0	,,
Bleaching Powder, 35% .... ,,	4	2	6	,,
Borax: British Refined Crystal......... ,,	12	0	0	,,

Coal Tar Products:	£	s.	d.	
Benzole, 50/90 % .... ,,	0	0	8	per gal.
,, 90% .... ,,	0	0	10½	,,
Carbolic Acid Crystals, 34/35° C. ... ,,	0	0	6⅜	per lb.
,, ,, ,, 39/40° C. ... ,,	0	0	7⅛	,,
,, ,, Liquid, 97/99 % ... ,,	0	0	9	per gal.
,, ,, Crude, 62½ % at 60° F. f.o.b. ,,	0	2	3	,,
Creosote, ordinary good liquid...... ,,	0	0	1¼	,,
Naphtha, Crude, 20 % at 120° C. ,,	0	0	3	,,
,, Solvent, 90% at 160° C.f.o.b ,,	0	0	8½	,,
,, ,, 95 % at 160° C. ,, ,,	0	0	9½	,,
,, ,, 90 % at 190° C. ,, ,,	0	0	10½	,,
,, Rectified, flash point over 73° F. ....f.o.b. ,,	0	0	10½	,,
,, Rectified, flash point over 100° F. ....f.o.b. ,,	0	0	11	,,
Naphthalene, all qualities.				
Pitch..............f.a.s. Manchester. ,,	1	13	0	per ton.
Copperas: Green, in bulk .... ,,	0	12	6	,,
,, barrels f.o.b. L'pool ,,	2	0	0	,,
Cake .... ,,	1	2	6	,,
Copper: Sulphate	22	10	0	,,
Cyanides: 98 % minimum ......f.o.b. net	0	0	7½	per lb.
Lead: Acetate (Sugar) White, English......	27	10	0	per ton.
,, ,, ,, Foreign c.i.f. U.K	24	10	0	,,
,, ,, Grey	21	0	0	,,
,, ,, Brown at Manchester	16	10	0	,,
Nitrate	23	0	0	,,
Litharge, Flake	15	10	0	,,
,, Powder	16	0	0	,,
Red Lead, Genuine, c.i.f. London less 5%	15	10	0	,,
White ,, ,, Dry ,, ,, ,,	16	15	0	,,
Naphtha (Wood): Miscible, 60 o.p..........	0	2	10	per gal.
Solvent..	0	2	7	,,
Potash: Bichromate... delivered England...	0	0	3	per lb.
Carbonate, 90/92 % ... c.i.f Hull ...	18	0	0	per ton.
Caustic, 75/80 % ...... ,, ,, ...	20	10	0	,,
Chlorate ....net	0	0	$3\frac{1}{16}$	per lb.
Montreal.........in Store, Liverpool	35	0	0	per ton.
Prussiate, Yellow ....net	0	0	$4\frac{15}{16}$	per lb.

		£	s.	d.	
Soda:	Ash, Caustic, 48 %, Ordinary ... ,,	5	5	0	per ton.
	,, ,, ,, Refined...... ,,	6	5	0	,,
	,, Carbonated, 48 %............ ,,	5	10	0	,,
	,, ,, 58 % (Ammonia Alkali) ....net	4	10	0	,,
	,, Bleachers' Refined Caustic 50/52 % .... net	6	10	0	,,
	Caustic, White, 77 %............... ,,	10	10	0	,,
	,, ,, 70 %............... ,,	9	12	6	,,
	,, ,, 60 %............... ,,	8	12	6	,,
	,, Cream, 60 %..... ....,	8	10	0	,,
	Crystals, in bags	3	0	0	,,
	,, barrels	3	7	6	,,
	Acetate .... c.i.f. Hull net	16	10	0	,,
	Bicarbonate, in 1 cwt. kegs............	6	15	0	,,
	Bichromate......delivered England...	0	0	2¼	per lb.
	Chlorate .... net	0	0	$3\frac{1}{16}$	per lb.
	Nitrate...ex quay Liverpool, ... ,,	11	0	0	per ton.
	Phosphate	9	5	0	,,
	Prussiate ....net	0	0	3⅝	per lb.
	Silicate, Solution, 140° Tw.	4	10	0	per ton.
	Sulphate (Glauber Salts)................	1	12	6	,,
	,, (Saltcake, 95%)...............	1	15	0	,,
Sulphur:	Recovered	4	15	0	,,
	Roll	6	15	0	,,
	Flowers....	7	10	0	,,
Zinc:	Sulphate	6	15	0	,,

MINERALS.

		£	s.	d.	
Barytes:	Lump Carbonate, 90/92%	3	10	0	per ton.
	Sulphate, No. 1, White	2	15	0	,,
China Clay:	of various qualities for all purposes; prices from about 11/- to about 30/- per ton, f.o.b. Cornwall: stocks also kept at Runcorn and Preston. Quotations given carriage paid.				
Chrome Ore:	Basis 50% c.i.f. British Ports..........	3	7	6	,,
Manganese:	Lump c.i.f. Liverpool 10½d.				per metallic unit.
Ochre:	French JC ... . f.o.b. Rouen, net	2	5	0	per ton.
	,, JF	5	10	0	,,
Talc:	(French Chalk).........c.i.f. Liverpool	3	10	0	,,

OILS, etc.

		£	s.	d.	
Aniline Oil	....................................net	0	0	4¾	per lb.
,, Salt	.... ,,	0	0	4½	,,
Castor Oil:	French, 1st pressure, f.o.b. Marseilles less 1¼%.........	20	0	0	per ton.
	English, 1st pressure, f.o.r. Hull, less 2½%.................	21	12	6	,,
Cocoa Nut Oil:	Ceylon, ex store Manchester...............net	31	10	0	,,
	Cochin, ex store Manchester.. ....net	33	0	0	,,
Cotton Seed Oil:	Refined at Hull, less 2½% naked	13	12	6	,,
	Edible...at Hull, less 2½% naked	14	2	6	,,
Glycerine:	Crude, 80% .... net	31	0	0	,,
Linseed Oil:	Raw... ..at Hull, less 2½% naked	13	2	6	,,
	Boiled......at Hull less 2½% naked	14	2	6	,,
Starch:	American Pearl...at Manchester, net	9	10	0	,,
	Dextrine............ ,, ,,	17	10	0	,,
	Farina............... ,, ,,	15	10	0	,,
Shellac:	Quiet sales TN orange, January delivery at........................		207/-		
Turpentine:	American.........at Liverpool	38	0	0	per ton.
	Russian ....at Hull...net	19	0	0	,,

TIMBER.

Messrs. Alfred Dobell and Co., Liverpool, quote:—

COLONIAL WOODS.

Timber.

		£	s.	d.		£	s.	d.
Quebec Square White Pine...	per cub. ft.	0	1	9	to	0	3	0
Quebec Waney Board Pine...	,,	0	2	8		0	3	9
St. John Pine, 18 in. average	,,	0	2	3		0	3	3
Lower Ports Pine..............	,,	0	1	3		0	1	8
Quebec Red Pine	,,	0	1	6		0	1	10
Quebec Oak, 1st quality	,,	0	2	9		0	3	3
Quebec Oak, 2nd quality ...	,,	0	1	6		0	2	6
Ash	,,	0	1	6		0	2	3
Elm	,,	0	3	0		0	3	6
Hickory	,,	0	2	0		0	2	6
Quebec Birch	,,	0	1	6		0	2	3
St. John Birch	,,	0	1	6		0	2	0
Birch Planks.....................	,,	0	0	9		0	0	11
Spruce Spars	,,	0	0	10		0	1	0

Deals.

		£	s.	d.		£	s.	d.
1st quality Quebec Pine	per std.	22	10	0	to	32	10	0
2nd do. do.	,,	17	0	0		22	0	0
3rd do. do	,,	11	10	0		13	0	0
St. John, N.B., etc., Spruce	,,	6	10	0		6	15	0
Lower Ports Spruce..	,,	6	0	0		6	10	0
Spruce Boards................	,,	5	10	0		6	0	0

UNITED STATES, etc., WOODS.

Pitch Pine.

		£	s.	d.		£	s.	d.
Hewn	per cub. ft.	0	1	3	to	0	1	8
Sawn	,,	0	0	10		0	1	6
Planks, Stowage	,,	0	0	10		0	1	0
Boards, Prime	per std.	12	10	0		16	0	0
Oak Timber	per cub. ft.	0	1	6		0	2	6
Oak Planks	,,	0	1	6		0	2	1
East India Teak...............	per load	12	0	0		15	0	0
Greenheart.....	,,	6	15	0		7	10	0

EUROPEAN WOODS.

Timber.

		£	s.	d.		£	s.	d.
Riga Redwood	per cub. ft.	0	1	9	to	0	2	3
Dantzic and Memel Fir, Crown	,,	0	2	1		0	2	6
Dantzic and Memel Fir, Middling	,,	0	1	9		0	1	10
Stettin	,,	0	1	9		0	1	11
Swedish................... ..	,,	0	1	2		0	1	4
Riga Whitewood	,,	0	1	3		0	1	6
Norway Mining Timber	,,	0	0	9		0	0	10
Dantzic and Stettin, etc., Oak..	,,	0	2	6		0	3	0
Norway Spars............... ..	,,	0	1	2		0	1	9

Deals.

		£	s.	d.	£	s.	d.
Red Archangel and Onega. 1st quality	per std.	19	0	0	20	0	0
Red Archangel and Onega, 2nd quality	,,	16	0	0	17	10	0
Red Archangel and Onega, 3rd quality	,,	12	10	0	15	0	0
St. Petersburg, 1st quality...	,,	16	0	0	17	10	0
Do. 2nd	,,	14	0	0	15	0	0
Gefle	,,	14	0	0	17	10	0
Wyburg	,,	12	10	0	14	0	0
Uleaborg	,,	12	10	0	14	10	0
Gothenburg	,,	14	0	0	17	10	0

SELECTED PATENTS.

Compiled expressly for this journal by **Messrs. Page and Rowlingson, Engineering Patent Agents, 28, New Bridge Street, London, E.C.,** and at Manchester.

Copies of Specifications may be obtained at the Patent Office Sale Branch, 25, Southampton Buildings, Chancery Lane, W.C., at the uniform price of 8d.

NEW PATENTS APPLIED FOR.

When Patents have been communicated the names of the communicators are printed in italics.

26,388. J. W. Russell, London. Dec. 5th.—Improvements in and connected with water-heaters, geysers, steam generators, and the like.

26,389. C. Buck, London. Dec. 5th.—Improvements in and connected with kitchen and furnace boilers.

26,401. G. Fisher and G. Krosli, Manchester. Dec. 5th.—Improvements in lubricators.

26,404. Steel, Peach and Tozer, Ltd., and H. E. Bowen, Sheffield. Dec. 5th.—Improvements in turnover mechanism for rolling mills.

26,418. L. Wilson, Greenock, N.B. Dec. 5th.—Improvein propelling vessels.

26,419. H. G. Cameron, Ilford. Dec. 5th.—Improvements in or relating to revolving cranes, or the like.

26,433. H. E. Soper, London. Dec. 5th.—Improvements in gas and like engines.

26,448. J. Reid, London. Dec. 5th.—Improvements in self-adjusting pump plungers.

26,465. R. Illemann, London. Dec. 5th.—Improvements in the manufacture of insulating coverings for steam pipes, boilers, and the like.

26,478. J. Heizmann, London. Dec. 5th.—Improvements in tubular apparatus for the interchange of heat.

26,491. F. A. Fromont, London. Dec. 5th.—Improvements in steam generators.

26,502. E. C. Robinson, Durham. Dec. 6th.—Improvements in vessels propelled by steam or other motive power.

26,505. F. L. J. Limozin, Braintree. Dec. 6th.—A combined three way cock and liquid measure.

26,518. P. Thomas and J S. Marsland, Halifax. Dec. 6th.—Improvements in steam engine air pumps.

26,519. H. W. Richards, and W. H. Richards, Manchester. Dec. 6th—Improvements in steam and low water safety valves for steam boilers.

26,523. W. Newlands, Edinburgh. Dec. 6th.—Furnace doors for land or marine boilers or wherever this door may be suitable.

26,525. R. P. Roy, London. Dec. 6th.—Apparatus for indicating, recording, and regulating temperature in steam generators and the like.

26,553. J. Milton, London. Dec. 6th.—Draught regulator for steam boiler furnaces.

26,583. W. Michalk, Liverpool. Dec. 6th.—Improvements in and connected with steam lubricating apparatus.

26,592. The Warwick Machinery Company Ltd., London. Dec. 6th.—Improvements in governors for steam engines. (*The General Electric Company, U.S.A.*)

26,598. The Warwick Machinery Company. Ltd., London. Dec. 6th.—Improvements in shaft packings. (*The General Electric Company, U.S.A.*)

26,617. A. Macdonald, Glasgow. Dec. 7th.—Improvements in and relating to variable speed regulators for machinery.

26,620. W. Baldwin, Blackburn. Dec. 7th.—Safety economical steam generator.

26,651. The Horsehay Company, Ltd., and T. H. Williams, London. Dec. 7.—An improved plug tap or cock.

26,652. H. M. J. von Metzen, London. Dec. 7.—A new or improved safety device for screw nuts and the like.

26,735 T. Staples, Birmingham Dec. 8th.—Improvements in steam boilers.

26,739, D. Marshall, Gloucestershire. Dec. 8th.—Improvements in or connected with means for locking nuts, bolts, and the like.

26,741. W. Anderson, H. Duncan, and W. Walker, London. Dec. 8th.—Improvements in rotary engines, pumps, and compressors.

26,764. G. Midgley, London. Dec. 8th.—Improvements in water gauges for steam boilers, and means for fixing same.

26,797. A. Adiassewich, London. Dec. 8th.—Improvements in steam generators.

26,835. G. W. Beldam, Liverpool. Dec. 9th.—An improved engine for machine packing.

26,863. N. F. Johnson and W. F. H. Hinde, London. Dec. 9th.—Improvements relating to fire-bars for furnaces of steam boilers.

26,870, R. H. Whitelegg, London. Dec. 9th.—Automatic variable blast pipe arrangement for locomotive engines.

26,880. H. S. Rexworthy, London. Dec. 9th.—Improvements in and relating to the supply passages and valves of pumping engines

26,891. W. Preidel, London. Dec. 9th—Improvements in screw propellers.

26,911. P. H. Deis, London. Dec. 9th.—Improvements in pumps. (Date applied for, January 11th, 1905.)

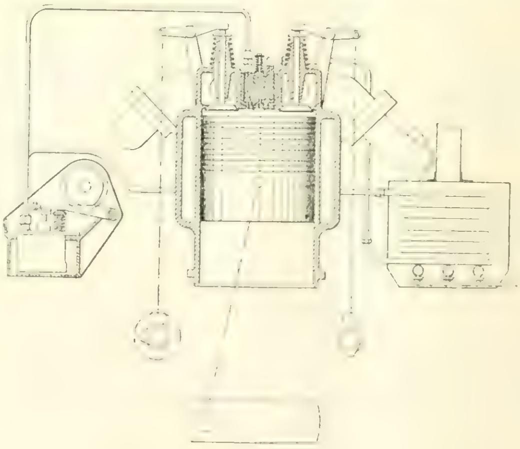
26,935. P. W. Lockwood, Glasgow. Dec 10th.—Improvements in and relating to direct-acting steam-driven pumps.

26,989. Simpson, Strickland and Co., Ltd., and G. F. Jarvis, London. Dec. 10th.—Improvements in or relating to water tube steam generators.

RECENT SPECIFICATIONS.

OIL ENGINES.

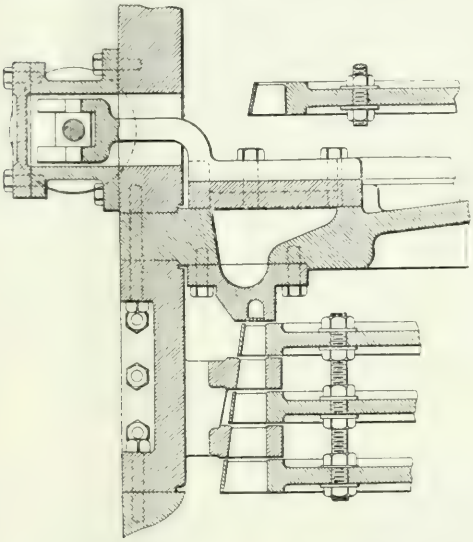
J. E. Thornycroft, Chiswick. Nov. 30th, 1904. — This invention has reference to oil engines of the Diesel type wherein oil is forced into a charge of air previously compressed to a high degree in the engine cylinder so that the combustible mixture of oil and air thus produced will be ignited by the heat due to the compression of the air. In such engines it has heretofore been usual to force the oil into the compressed air by means of compressed air obtained from a

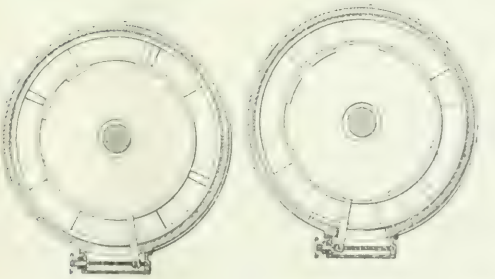


separate air pump cylinder. According to this invention, in order to increase the efficiency and improve the working of such engines, and also to obviate to some extent the great waste of heat that usually takes place therein by reason of the necessity of water jacketting the combustion chambers and engine cylinders, the oil is forced into the compressed air in the combustion chamber by means of high pressure steam, which when the combustible mixture of air and oil explodes, will, by the absorption of some of the excess of heat of combustion, be further increased in pressure, and by admixture with the products of combustion and hot gases, will form a more efficient motive fluid for working the engine than the products of combustion and hot gases alone, as heretofore. To effect the desired result means are provided for introducing and compressing air in the engine cylinder, together with an oil pump adapted to deliver regulated quantities of oil. The steam generator is of the flash or Serpollet type, a water pump adapted to feed water intermittently to the steam generator is used, and a valve device for controlling the passage of oil and steam from the oil pump and steam generator to the combustion chamber of the engine cylinder, the arrangement being such that the valve device will act to allow oil to be blown or sprayed by high pressure steam into the air in the combustion chamber after such air has been compressed and thereby heated to the required degree.

STEAM ENGINES.

The Warwick Machinery, Company, Ltd. (Communicated by the General Electric Company, of Schenectady, U.S.A.) Dec. 12th, 1903.—In a multi-stage elastic fluid turbine a number of nozzles or nozzle sections are arranged in groups in connection with a distribution chamber anterior to each group, and supplying it with motive fluid, and a valve is mounted on the diaphragm between two stages of the turbine, which valve controls the inlets of the distributing chambers formed in the diaphragm, and controls the passage of fluid therethrough. Each stage is provided with a valve mechanism for regulating the volume of steam or other motive fluid delivered to the adjacent wheel of lower pressure, so that the highest possible efficiency may be obtained. The valve mechanism is arranged so that the nozzle sections can be cut into or out of service without throttling the flow of motive fluid through any particular section.





STEAM ENGINES.

Otto Kolb, Karlsruhe, Germany. Feb. 17, 1904.—This invention relates to a method of forming the nozzles of an elastic fluid turbine so that the fluid enters the buckets of the turbine in an expanded condition, and in order to effect this, the first series of nozzles is formed with a diminished central section to allow of the expansion of the elastic fluid as it enters the turbine. The amount of contraction and expansion may be varied by means of an adjustable side to the nozzle. A further improvement consists in providing a number of consecutive secondary nozzles of increasing areas arranged alternately on the two peripheries of the turbine wheel, and adapted to receive and to direct the motive fluid on to the latter in the direction of the rotation of the same.

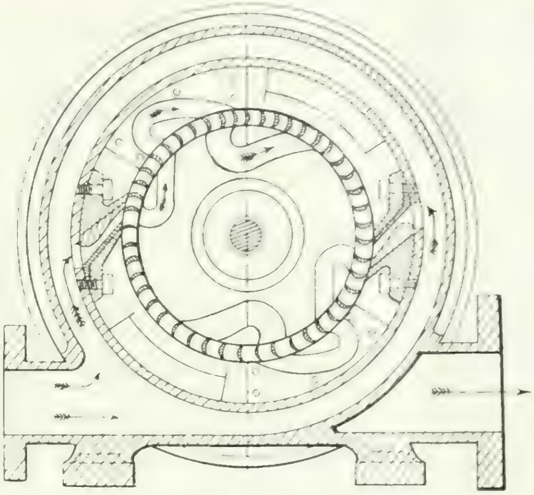


FIG. 1.

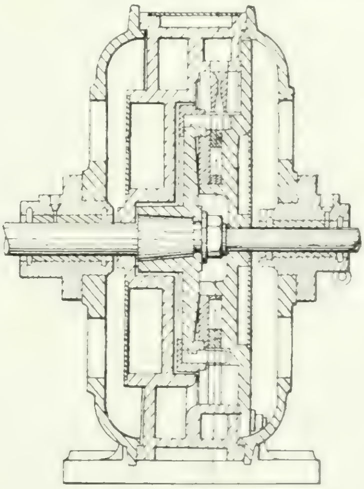


FIG. 2.

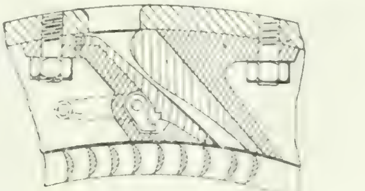


FIG. 5.

NEW PUBLICATIONS.

"MACHINE DRAWING."

For Students preparing for the Science Examinations in Technical Institutes and Evening Schools. By Alfred P. Hill. P. S. King and Son.

An excellent collection of detailed drawings, with descriptive letterpress, the aim of which is to enable engineering students to obtain a practical knowledge of machine drawing, and at the same time study the elementary calculations connected with simple machines.

"WHO'S WHO."

Adam and Charles Black. 7s. 6d. net.

We extend a hearty welcome to this wonderfully complete and indispensable biographical reference book. This year's issue contains over 1,700 biographies, and the knowledge that each notice has been submitted for personal revision increases our admiration of the able manner in which the editors of this unique compilation have accomplished their annual task.

From the same publishers we have also received the Englishwoman's Year Book and the Who's Who Year Book, a handy work upon which considerable pains appear to have been expended in order to ensure complete accuracy.

"APPLIED MECHANICS."

An Elementary Manual, specially arranged for the use of first-year Board of Education, South Kensington, City and Guilds of London Institute, Colonial and other Engineering Students. By Andrew Jamieson, M.Inst.C.E. Charles Griffin and Co., Ltd. 3s. 6d.

The new edition of Professor Jamieson's remarkably clear and well-written compendium has been thoroughly revised and brought up-to-date—for instance, the hexagon turret lathe, which was recently dealt with in PAGE'S WEEKLY, is fully described and accompanied with detailed sectional drawings. It is divided into four stages, covering, forces in equilibrium and the principle of moments and of work as applied to simple machines; hydraulics and hydraulic machines; laws of motion, velocity, acceleration, etc., and properties and strengths of materials, chains, shafts, and beams. The illustrations are a strong feature, and at the end of several lectures the author has incorporated all the most important questions set by the Science and Art and Board of Education, during the past twelve years. Altogether, the work is one of the most suitable for the first-year student, and is calculated to give him a solid grounding in the fundamental principles of his profession.

"PRACTICAL ELECTRICITY AND MAGNETISM."

By John Henderson, D.Sc., F.R.S.E., A.M.I.E.E. Longmans, Green and Co. 6s. 6d.

This work forms the second volume in the promising series of Physical and Electrical Engineering Manuals. The general arrangement and treatment of the subject matter is all that could be desired, the author, dealing with his topic under the following heads, Measurement of Resistance; Measurement of Current; Measurement of Electro-Motive Force; Measurement of Quantity of Electricity; Measurement of Capacity; Magnetism; Electro-Magnetic Waves. The appendix comprises a useful series of tables of logarithms, antilogarithms, reciprocals, tangents, squares, sines, etc.

NEW CATALOGUES.

We congratulate Messrs. J. and H. McLaren in having struck a somewhat novel line in "McLaren's Traction Engines and their Uses." The introductory pages contain some very interesting personal reminiscences, together with excellent portraits of Messrs. John and Henry McLaren; there is also a good description of the works. Other sections are devoted to Thrashing Engines, Heavy Haulage Engines, Military Engines, Carriages, Wagons, etc., and Steam Ploughing Machinery, while the concluding pages are concerned with pioneer work in the Colonies. The production is exceptionally well illustrated and can scarcely fail to find a wide circulation of readers.

From this firm we have also received a well-printed booklet calling attention to McLaren's Open-Type, Medium-Speed Triple-Expansion Electric Generating Engines; High-Speed Enclosed Triple-Expansion Steam Engines; and Condensing Plant. There are some excellent half-tone blocks and diagrams, and from the introductory remarks we are reminded that these works were established in 1876. Amongst stations at which the Company's engines are working are mentioned Leeds, Sheffield, Huddersfield, Oxford, Coventry, South Shields, Swansea, New University, Birmingham, Harrogate, Stockton-on-Tees, Wakefield, Hammersmith, etc.

Stenotyper Schools of Machine Shorthand. (The Stenotyper Shorthand Machine Co., 8, Bush Lane, Cannon Street, E.C.)—We have received several pamphlets from the above school on stenotypy, by which, instead of stenographic characters, a record can be made of spoken language by means of a machine with six keys, which are struck singly or in chords as on the piano. The printed record is a system of dots and dashes. It is claimed for the system that only a short period is required in which to become efficient, while the notes obtained are readable by any stenotypist after any length of time, if filed away. Those interested should obtain full details from the Company.

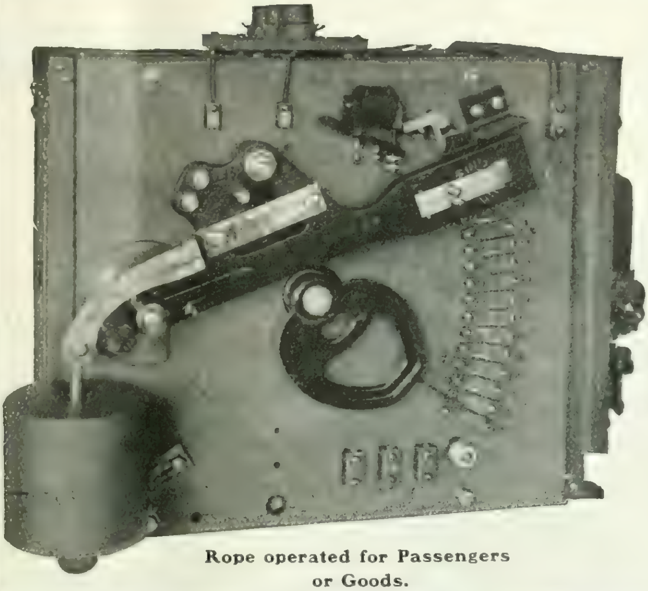
CALENDARS.

A HIGHLY artistic calendar has been issued by Messrs. William Augustus Gibson, Ltd., makers of Hydraulic and Electrical Lifts, of Temple Bar House, Fleet Street, E.C. The calendar lettering and the firm's advertisement have been treated with considerable restraint, the general effect being that of a picture in colours, approximately 9 in. by 13 in., mounted upon a dark grey frame some 4½ in. in width. The subject is an old mill at sunset, from a painting by H. Farrer. The calendar proper is rendered in white on grey slips, and the picture is tied with a brown silk cord.

The United States Metallic Packing Company, Ltd., are again to the fore in the matter of calendar production, the subject chosen this year being a statue of Atalanta, rendered in bas relief. The treatment is most artistic, and the *tout ensemble* pleasing. The calendar will be welcomed both for its ornamental qualities and its practical utility.

A useful time "economiser" has been issued by Messrs. E. Green and Son, Ltd., Wakefield, in the shape of a heavy glass paper-weight. It incidentally calls attention to Green's economiser for steam boilers and their effect upon the coal bill.

LIFT CONTROLLERS.



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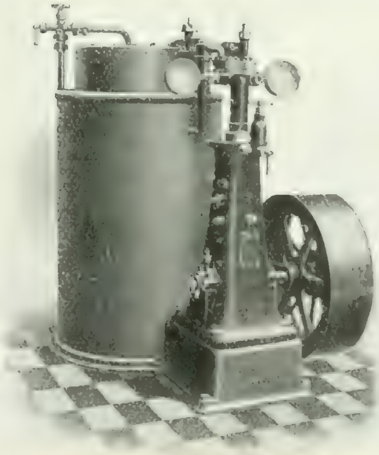

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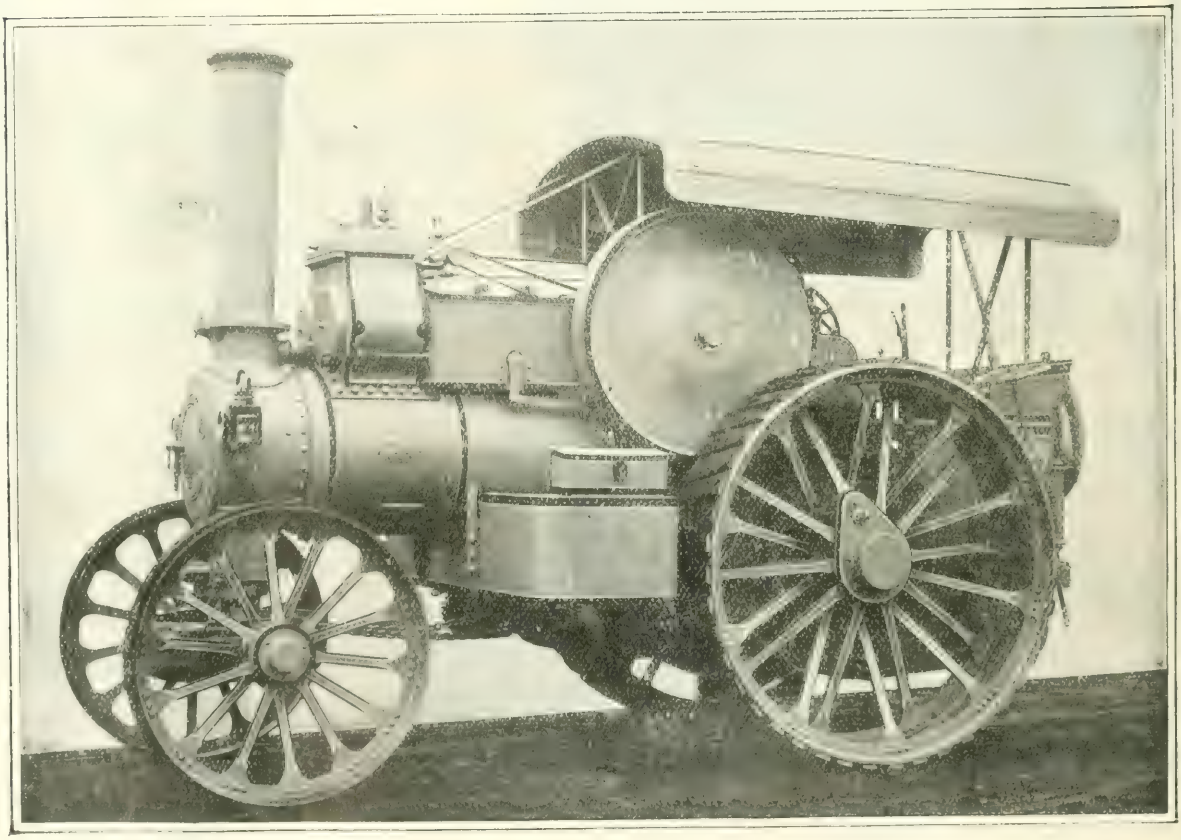

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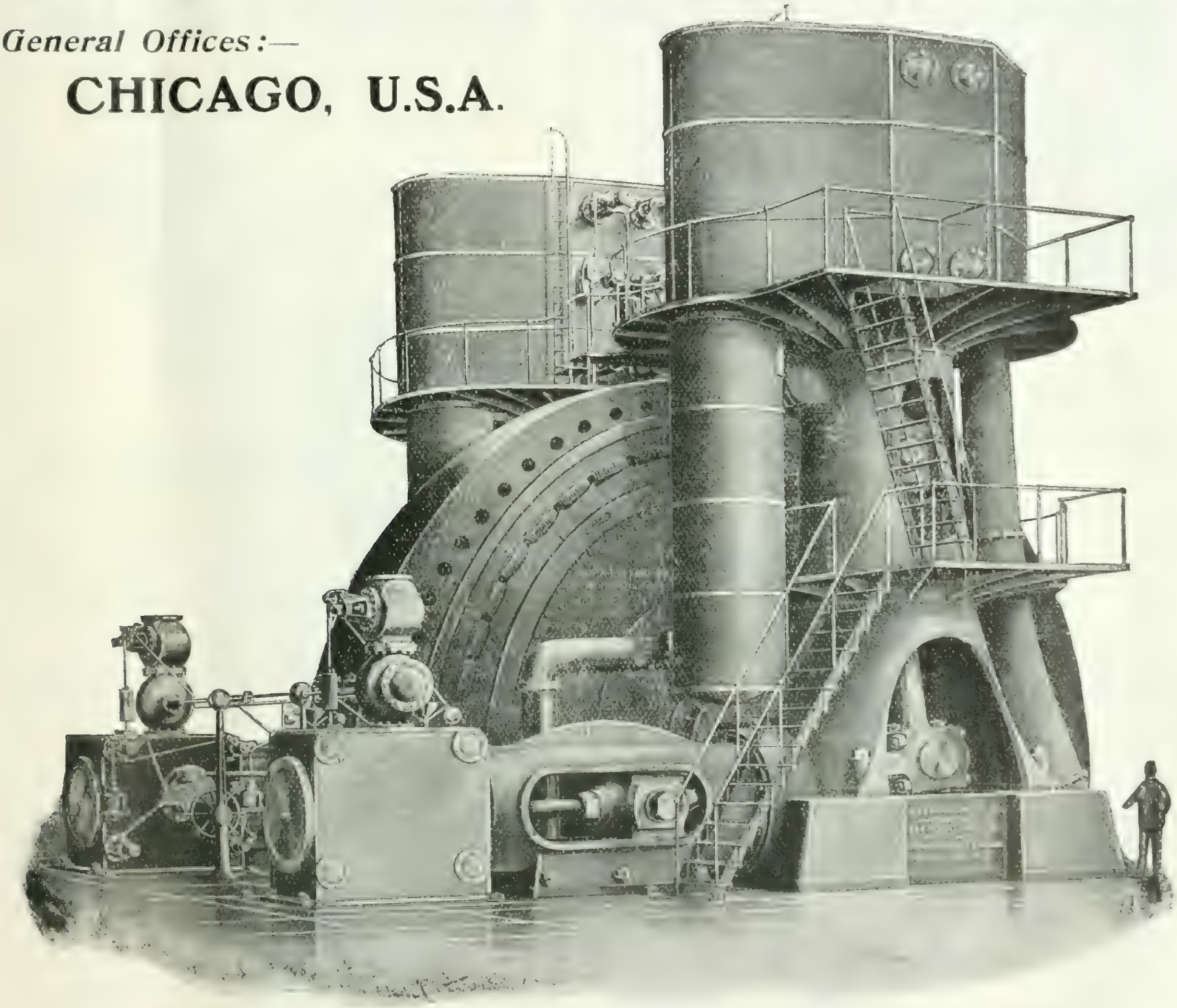

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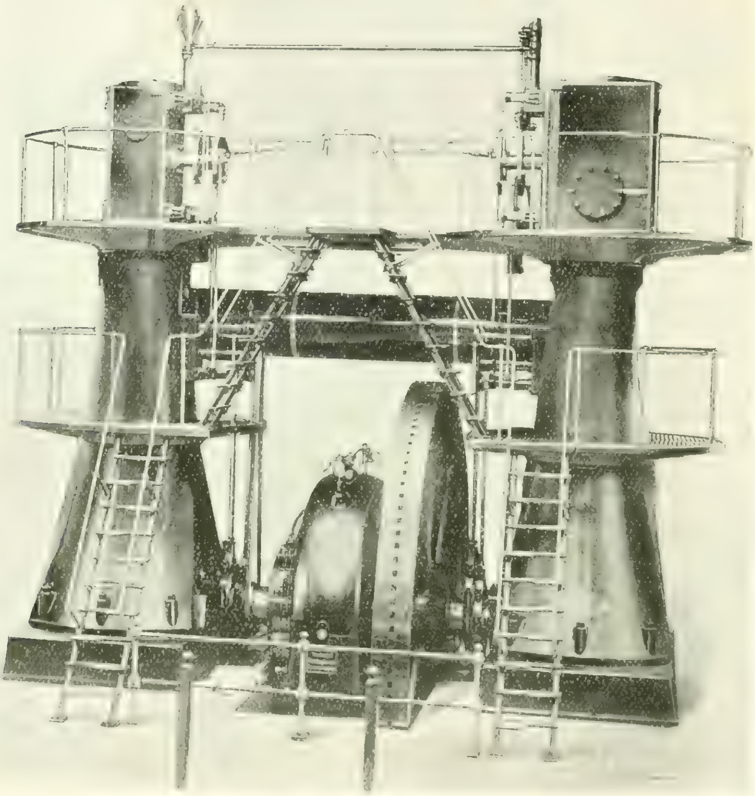

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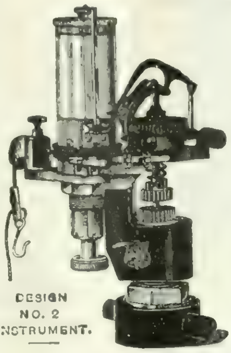

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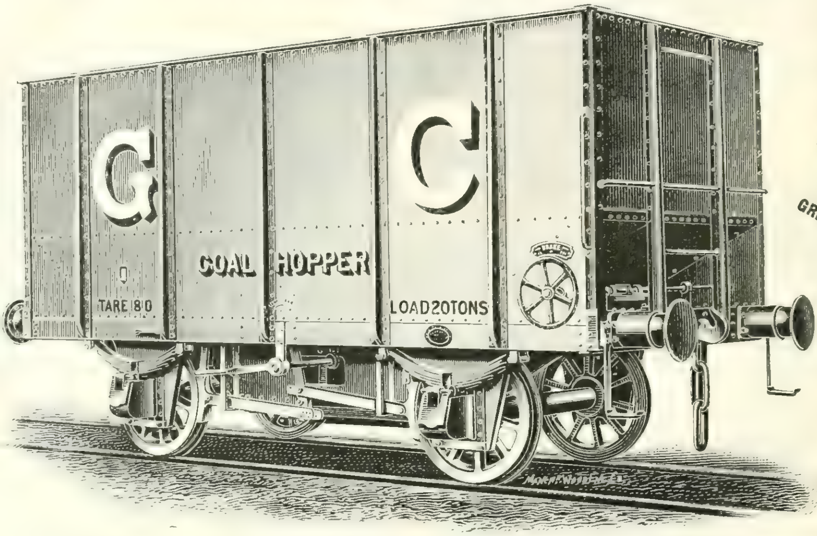

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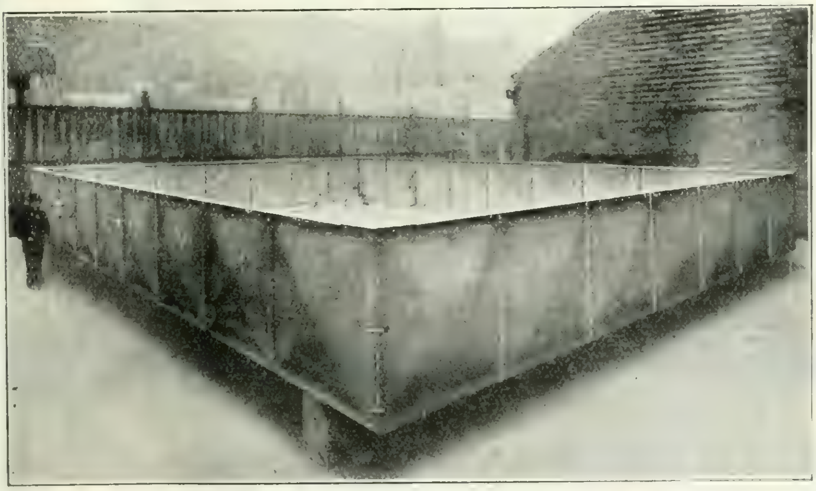

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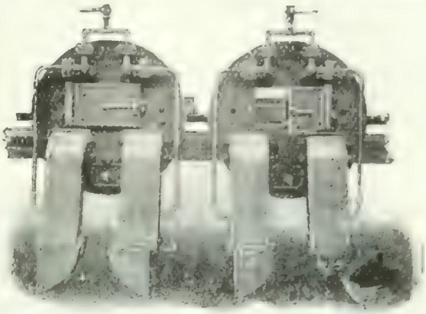

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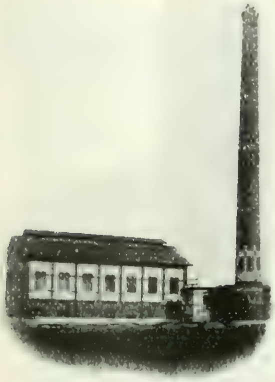

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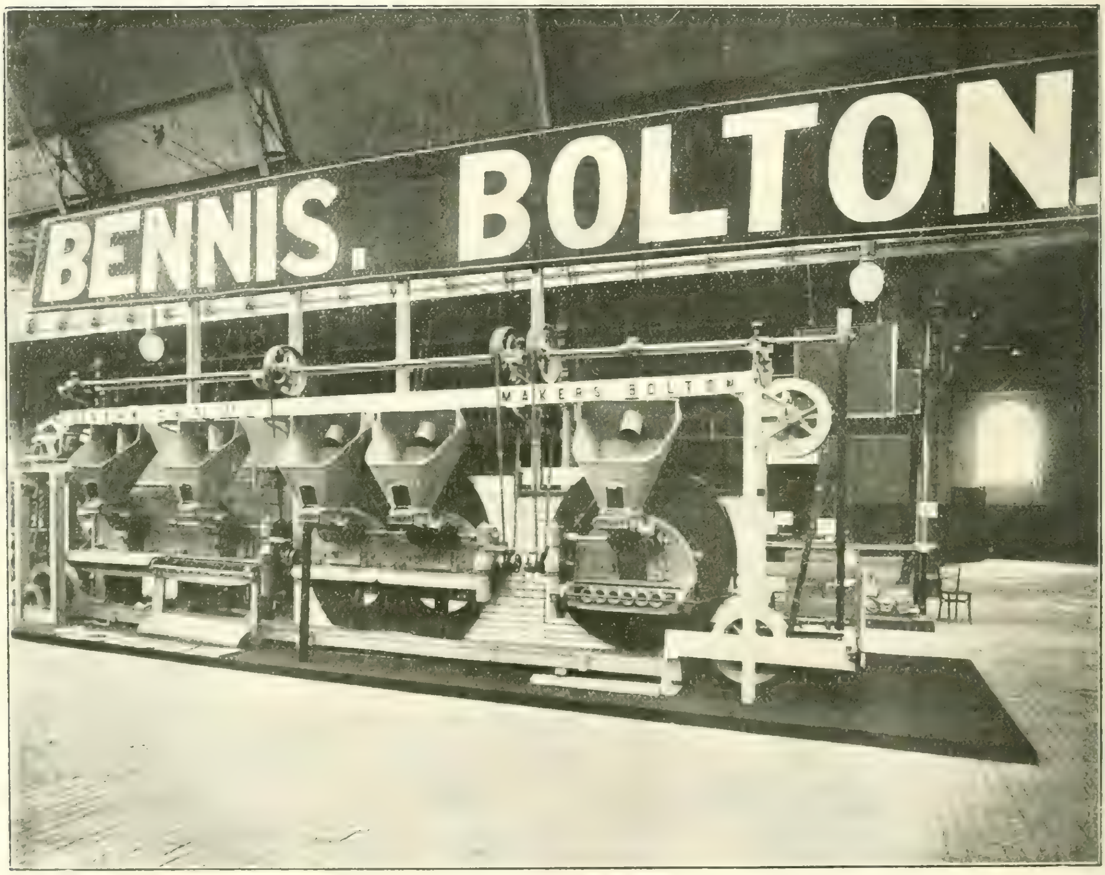

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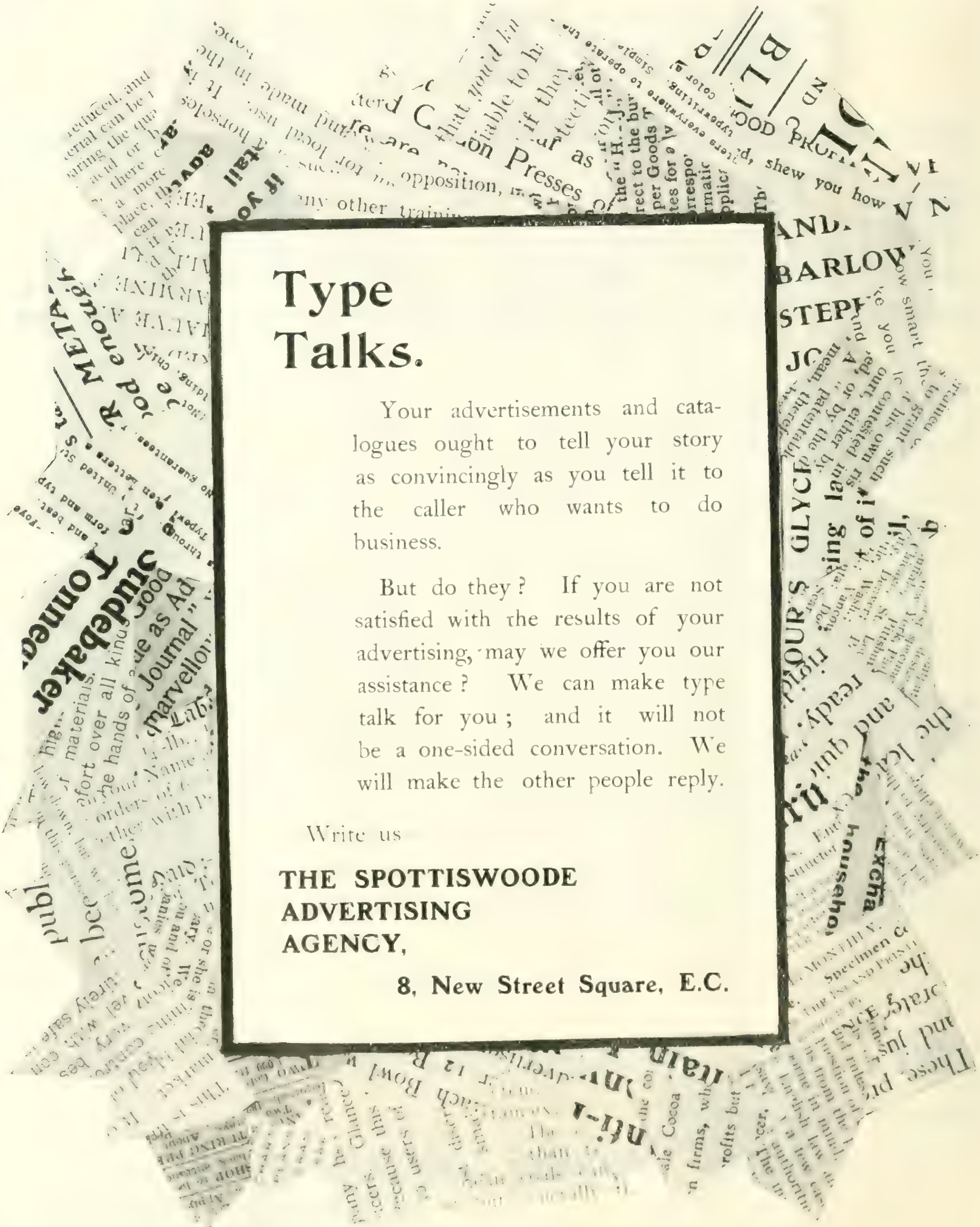

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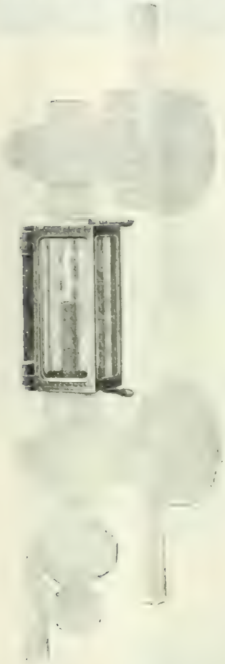

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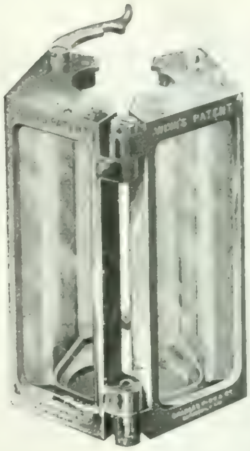

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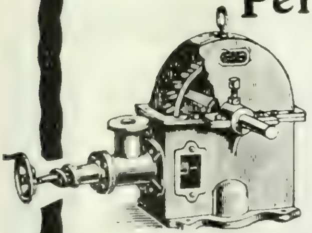

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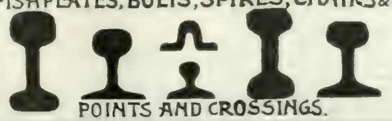

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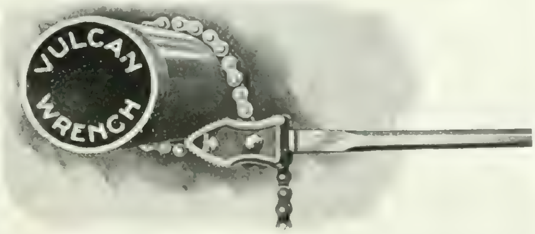

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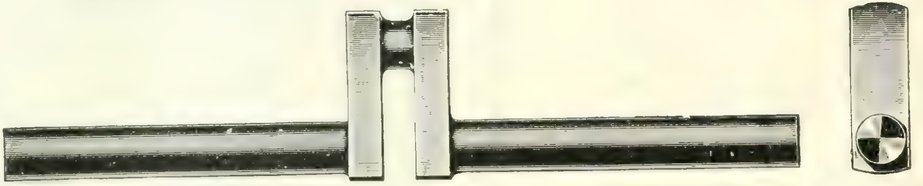

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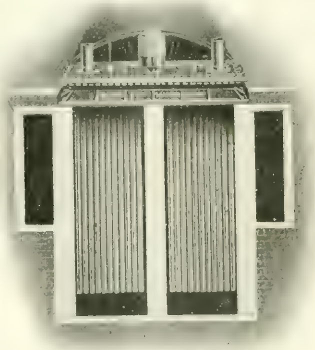

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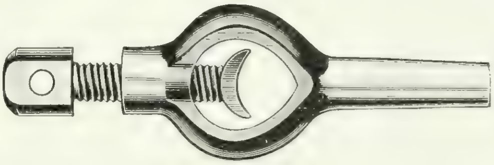

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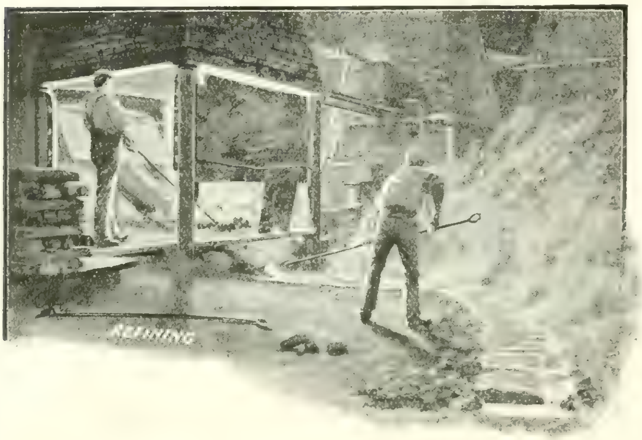

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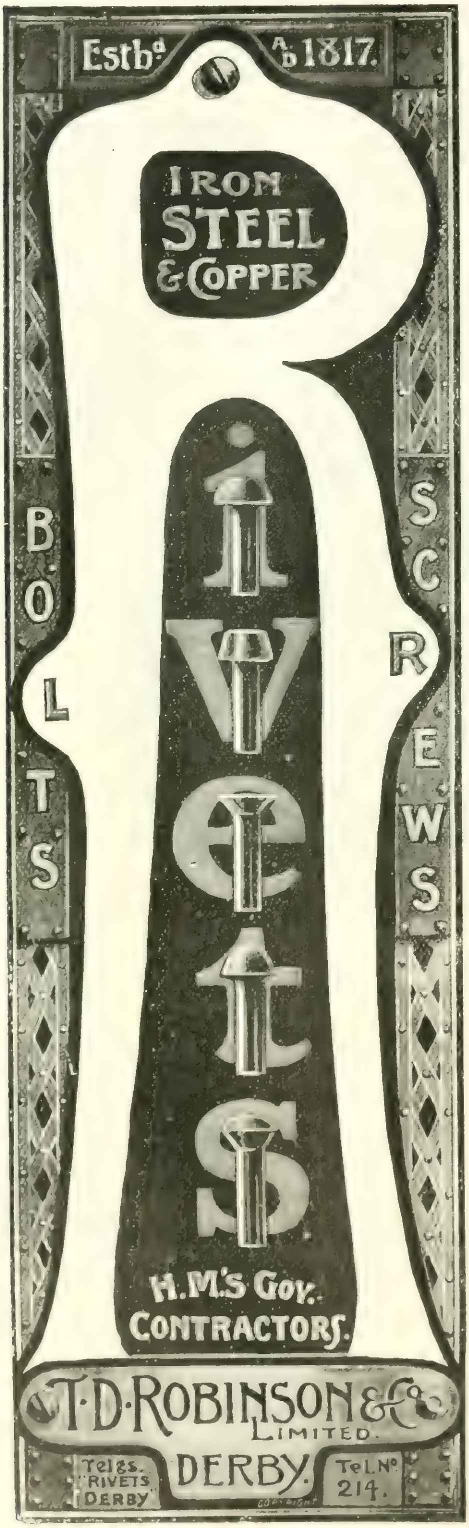

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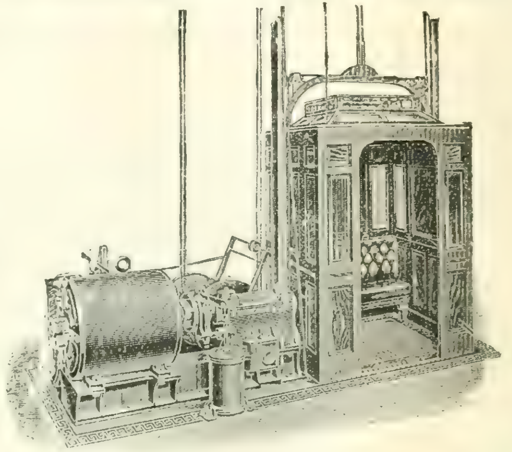

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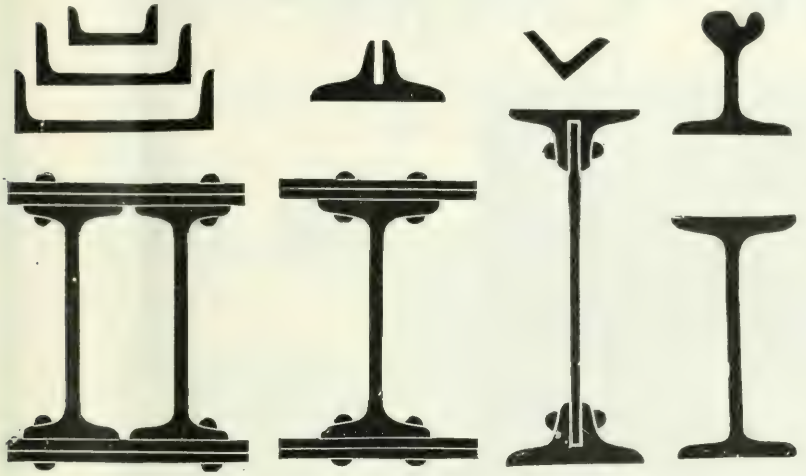

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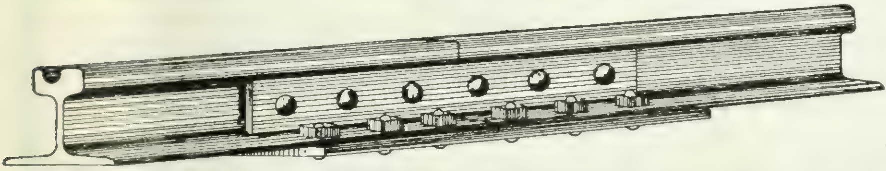

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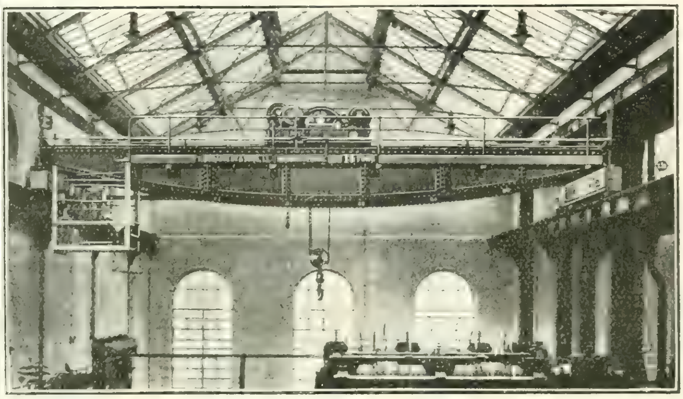

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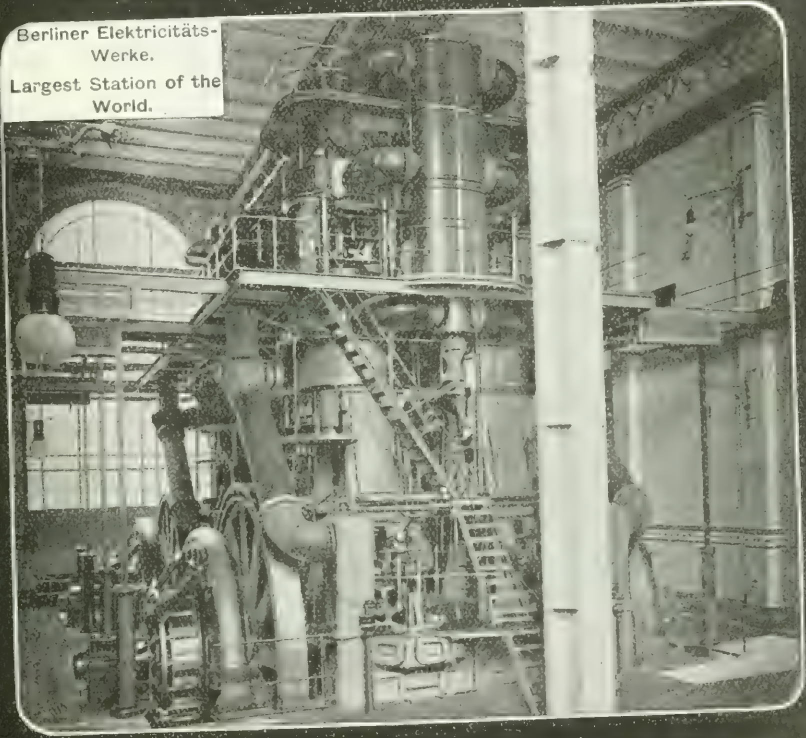

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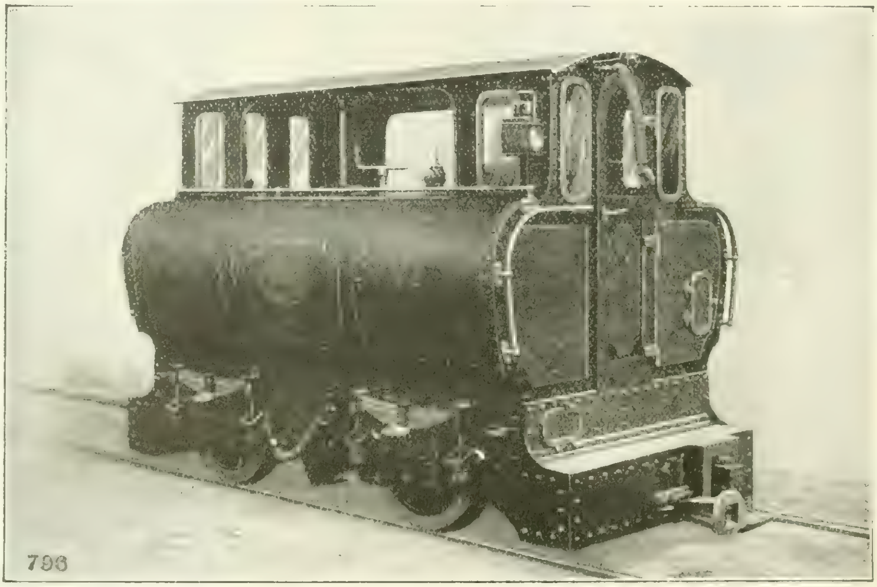

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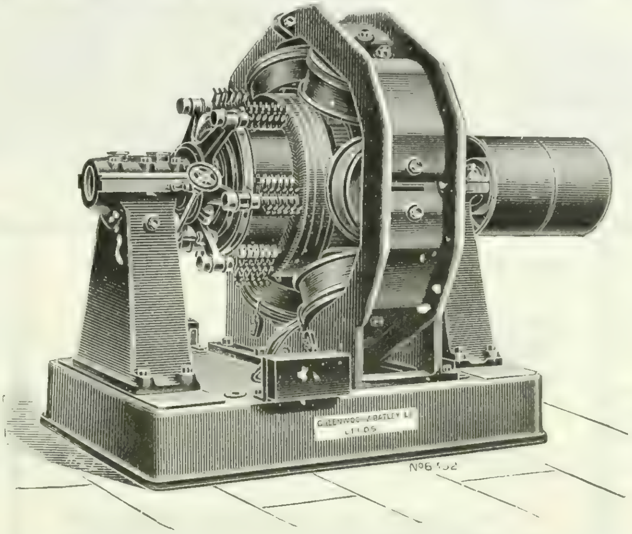

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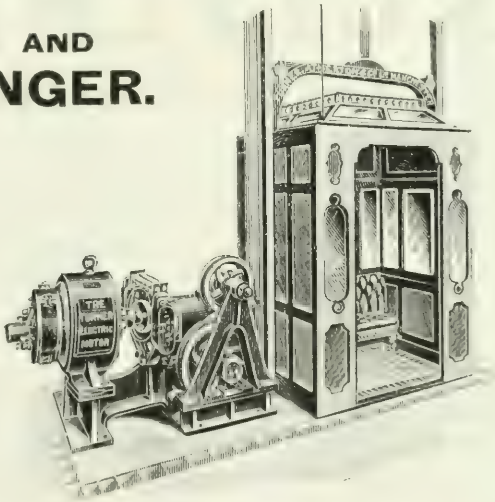

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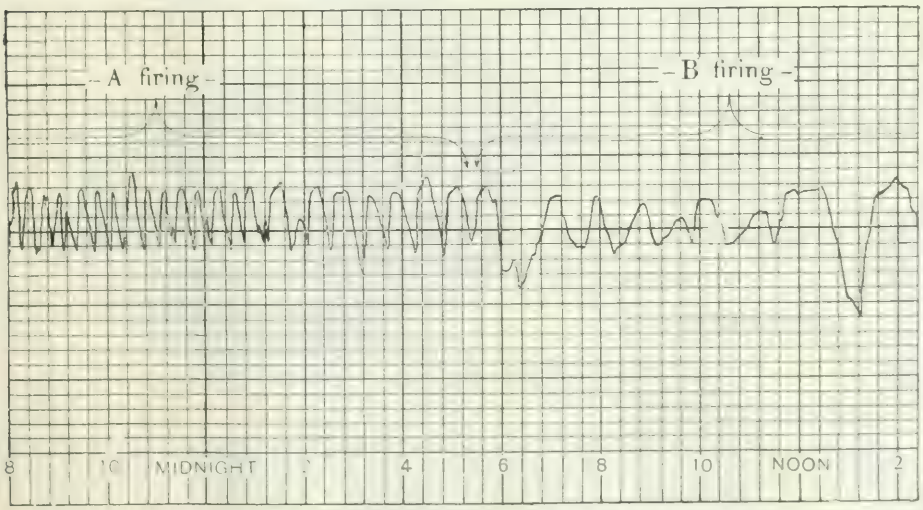

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No.......... *Order No*..........

Date..............................

Department..............................

Day.		Began	Stop	Re Start	Finish	Total.
F	a.m.					
	p.m.					
S	a.m.					
	p.m.					
SUN	a.m.					
	p.m.					
M						

No.............

THIS SIDE OUT.

Operation.	No.	Parts.
Assembling ..		
Boring......	3	Cylinders.
Brazing		

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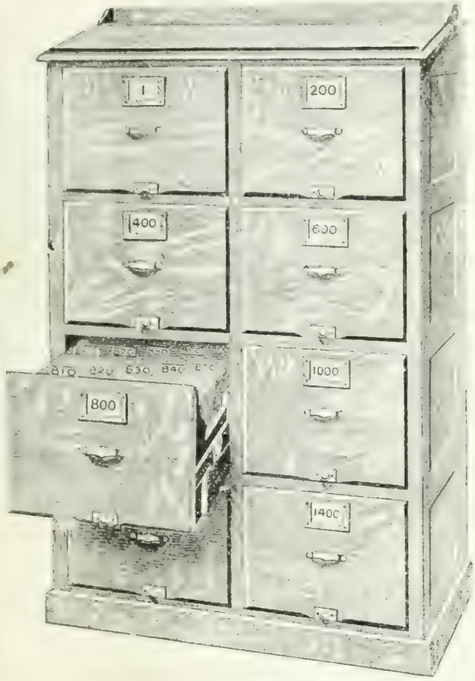

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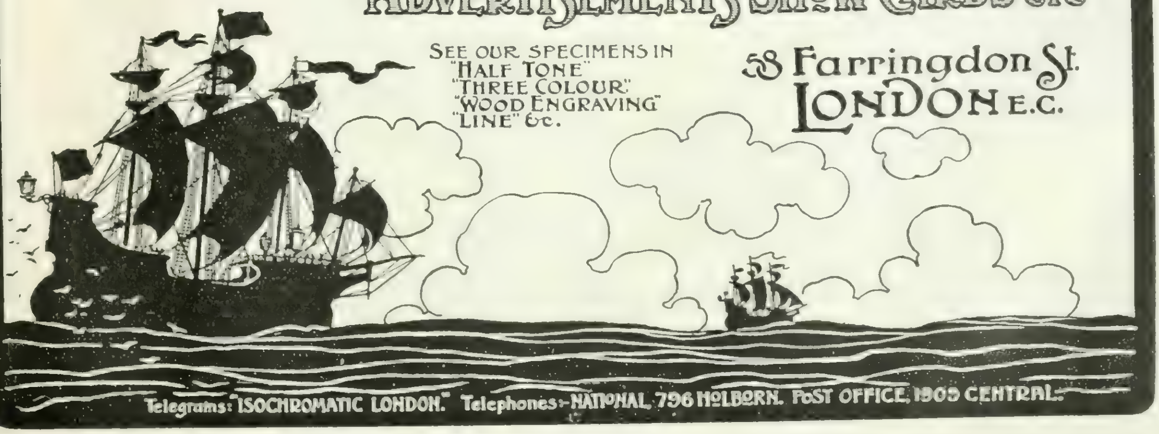

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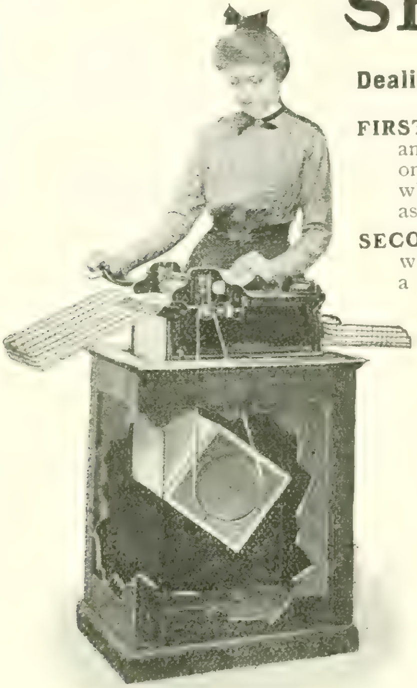

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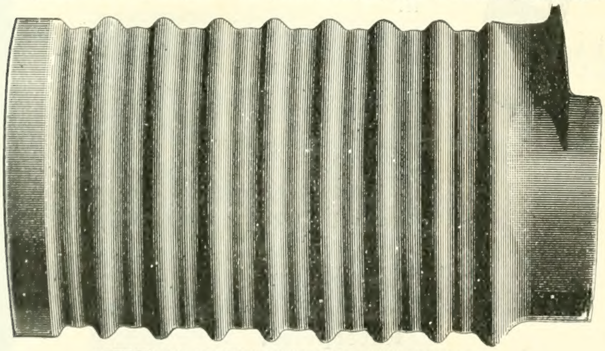

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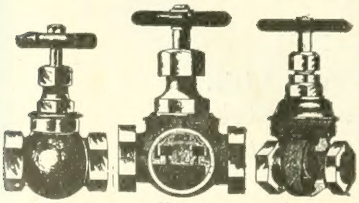

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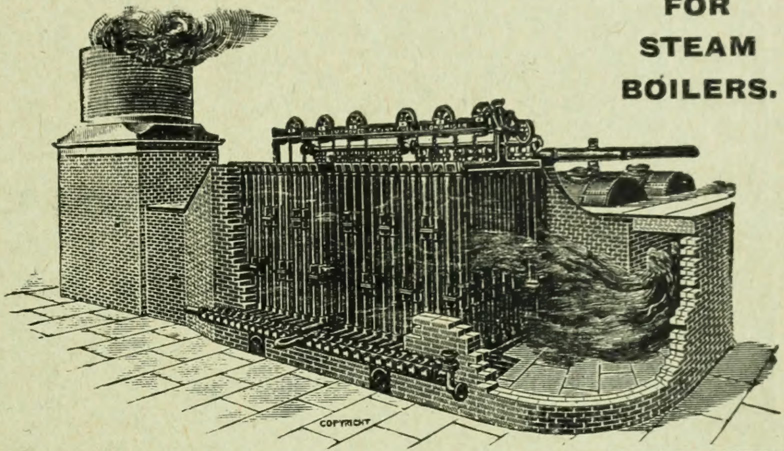

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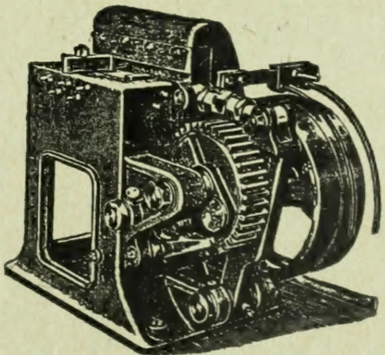

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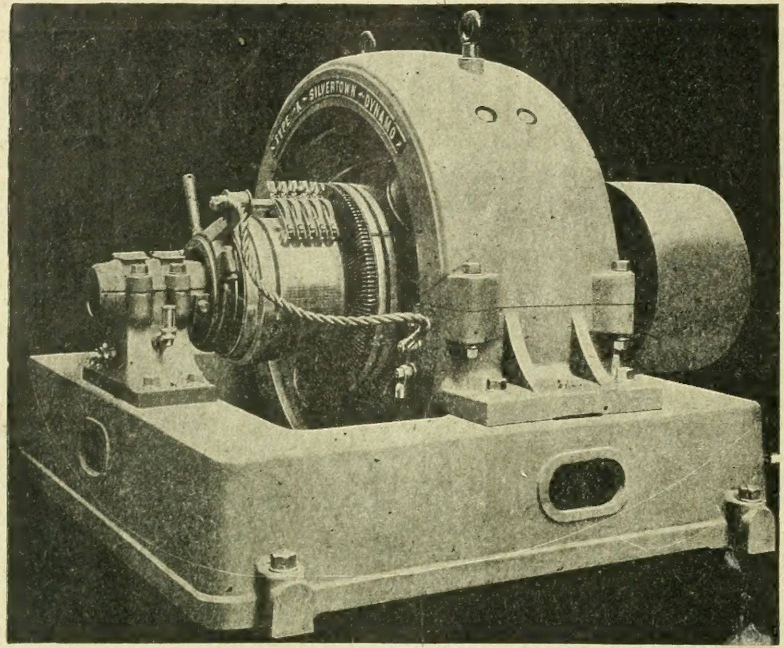

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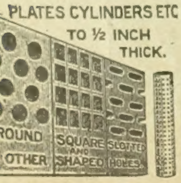
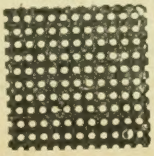


Perforated Copper.



Perforated Metals, Wire Work, Gauze, Metallic Name Plates } Of all Descriptions.

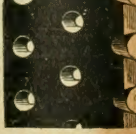
W. BARNS & SON,

Christopher Works,
Chalton Street, Euston Road,
London, N.W.

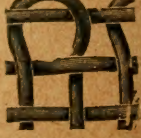
Metallic Name Plates.

W. BARNS & SON.
CONTRACTORS FOR NAME PLATES
TO THE ADMIRALTY.

Taper Holes.



Wire Work of all kinds.



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